

1989 markets softening but industry pace is high

by Gordon Duffy

It's a year when significant negative impacts could stem from events that, at first blush, might appear to be good for the nation and for the hvac industry. The most obvious is that the economy is strong. Yet if it keeps growing at its present pace, we can expect higher inflation rates, credit tightening, or both.

Higher long-term interest rates, particularly in the first half of the year, will take some of the bloom off already wilting single-family home starts. Higher short-term rates will hurt the renovation and efficiency upgrade markets. And higher bond returns could slow this year's rising star, industrial construction.

With national unemployment hovering at 5%, and construction employment below 10% for the first time in a decade, there will be greater pressure for wage increases in 1989. And, after two unusually hot summers in a row, the search for qualified technicians is among contractors' biggest problems. They also face

rapidly changing technology and more emphasis on merchandising.

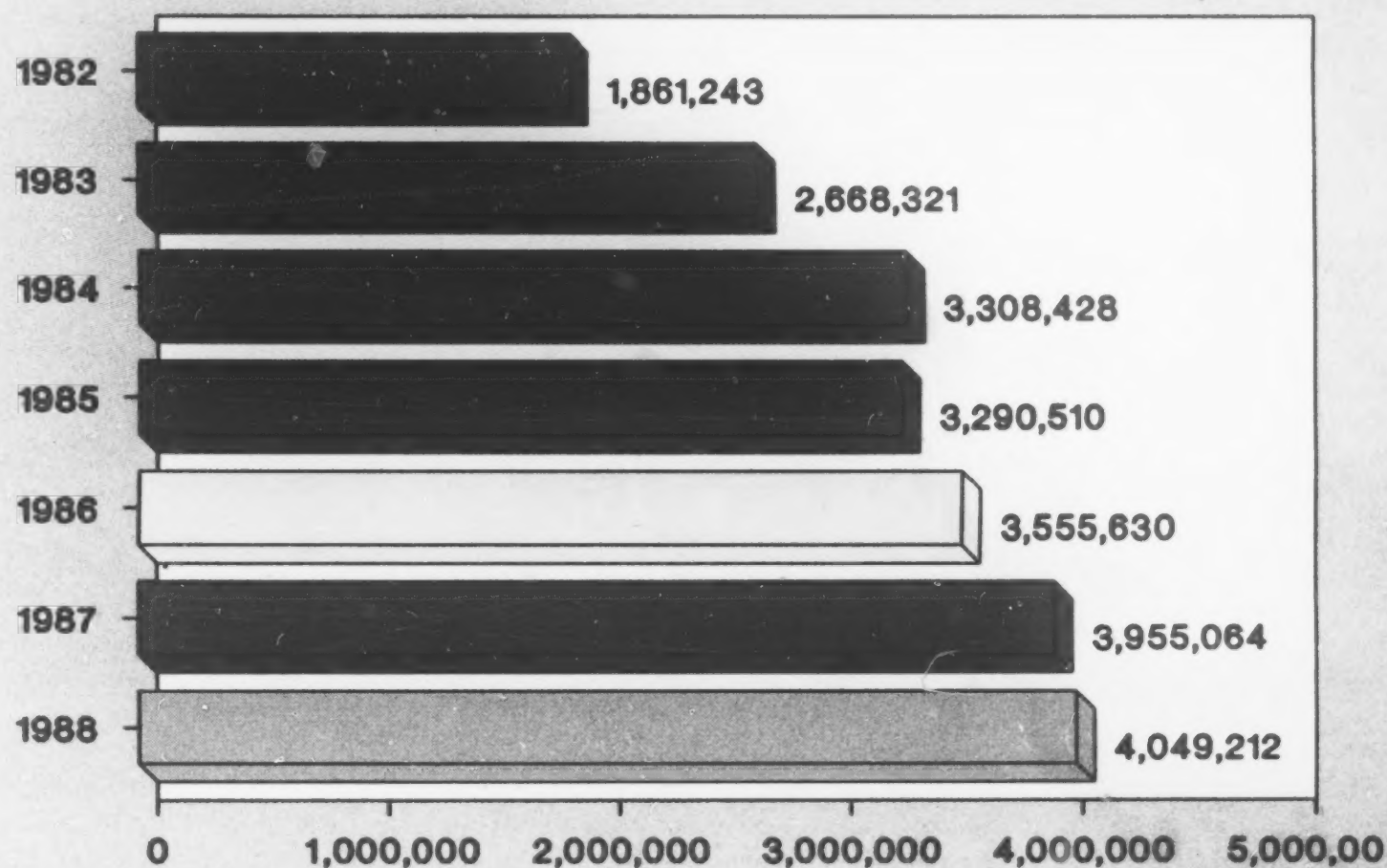
Exporters are more competitive because of a weaker dollar when matched with the yen, the mark, and the pound. But it's not helping in debt-ridden South America, or in countries whose currencies are tied to the U.S. dollar. And, as interest rates rise abroad, U.S. interest rates must follow in order to attract the foreign capital made essential by a continuing massive federal deficit.

Having said all that, we find that 1989 should not be a bad year. Far from it. Cutbacks will be modest. Residential markets are on a high plateau only dreamed about a few years ago. Replacements and renovations will take much of the sting out of sagging large and small commercial markets. And interest in efficiency continues to be strong despite moderating energy prices.

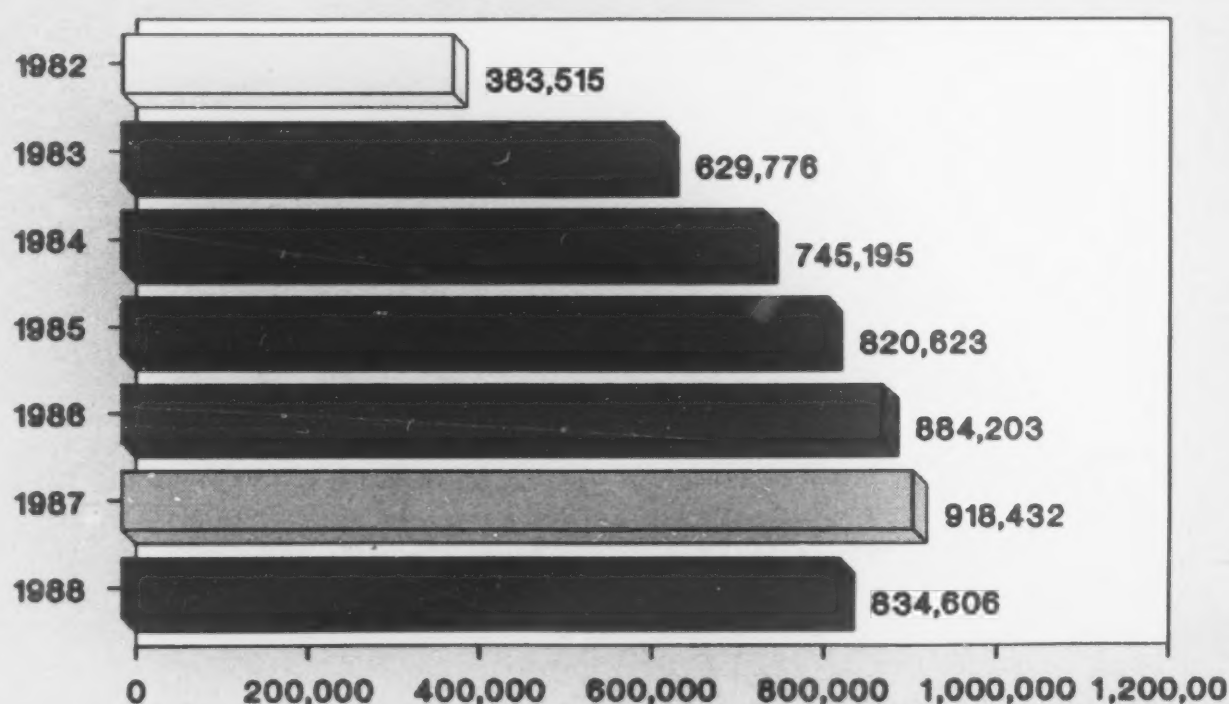
All in all, it will be a good year. For details, turn to page 5 and beyond.

STATISTICAL PANORAMA

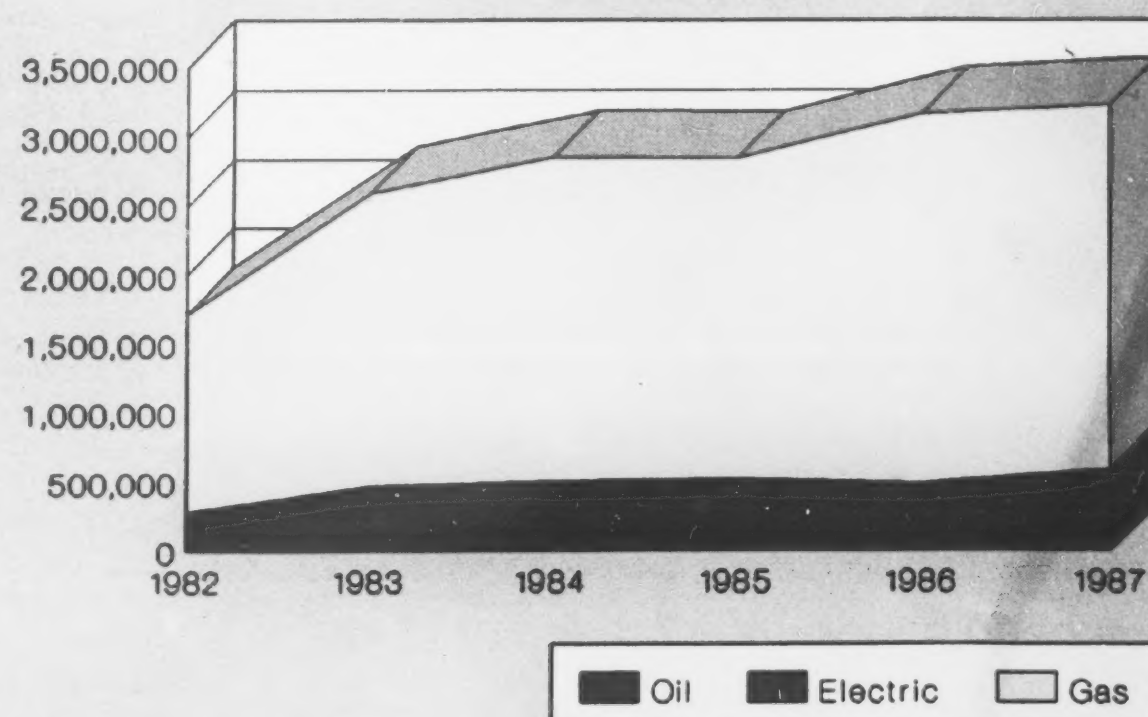
UNITARY AIR CONDITIONERS



HEAT PUMPS (air-to-air)



FURNACES (Gas, Oil, Electric)



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Where did they go?
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Let comparison be your management guide--

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statement expresses the important accounts as a percentage of total sales. A balance sheet expresses each account as a percentage of total assets or total liabilities and owner's equity.

To illustrate how to use such statements, assume that accounts receivable represent 55% of a contractor's total assets. However, a look at the common-size balance sheet for hvac contractors indicates that the typical firm's accounts receivable represent only 44% of its total assets.

By simple comparison, the contractor learns that the firm's proportionate investment in accounts receivable stands well above the industry average. That disparity from the norm signals the existence of a potential problem.

Loose credit policy

The contractor may have a loose credit policy that continues to approve sales to slow-paying customers. Or perhaps the contractor's collection effort needs improvement. The disparity can provide the stimulus for corrective action.

Of course, a contractor may have ample justification for carrying receivables that exceed the industry norm. Perhaps the firm uses

liberal credit and collection policies to stimulate sales. The profits from those sales easily may compensate for the problems associated with selling to slower-paying customers.

RMA also presents comparative information using prominent financial ratios. A contractor can use those ratios in the same manner as the common-size financial statements.

Let's use the current ratio to illustrate. It provides a general measure of a firm's liquidity, or its ability to absorb an unforeseen financial setback. The ratio relates a firm's total current assets to its current liabilities. A business with \$200,000 in current assets and \$100,000 in current liabilities has a two-to-one current ratio.

Standing alone, that ratio doesn't tell us if it represents an adequate level of liquidity. However, a look at the comparative ratio for contractors in the studies indicates that the average contractor doing less than \$1 million annually has a 1.7 current ratio.

That suggests that a contractor with a lower current ratio may have a potential liquidity problem. A contractor with a higher current ratio probably enjoys a higher level of financial security.

However, any comparison must

acknowledge each firm's particular circumstances.

Different ratios

For example, a contractor with a low current ratio may be able to operate with less inventory because of access to nearby suppliers. Another contractor may have a lower ratio because of effective credit and collection practices that hold down its accounts receivable. Still another contractor may operate with smaller cash balances and a lower current ratio because of access to a bank line of credit.

In any event, comparative data can help orient one's analysis. The comparative data do not necessarily represent the ideal financial circumstances. But a serious departure from industry averages deserves explanation, if not alteration.

At the same time, a contractor cannot rely solely on external standards to guide his financial management. He should also perform internal trend analysis, comparing current financial ratios against those for the previous year. He also may compare current financial ratios against those from the previous month or quarter.

Here, he really has two tasks. First, he should look for disturb-

ing financial trends — for an increase in his average collection period for the firm's receivables from 40 to 50 days. That increase inevitably leads to a higher investment in receivables and higher financing costs for carrying them. It also leads to higher bad debt write-offs.

As another example, a contractor should react to a net profit margin that drops from 6% to 4% in successive operating periods. Moreover, that reaction makes sense even though both margins exceed the industry average for hvac contractors producing under \$1 million in sales. A negative trend in any circumstance deserves management attention.

From the other perspective, a contractor should try to improve positive trends. A contractor shouldn't rest because his net profit margin increases from 4% to 6% in successive years. Note that internal and external comparative analyses complement one another. Moreover, recognize that a contractor doesn't need to be a financial expert to make sound financial management decisions. Simply use your common sense, and let comparison be your management guide.

Bryan E. Milling writes on a variety of tax and business topics.

Utility's major overhaul requires engineers' ingenuity

SAN LUIS OBISPO, Calif. — Engineering ingenuity, extensive preparations, high-pressure hydraulic power, and 42 days of around-the-clock rigging and moving were key elements in removing and replacing 31 heat exchangers at a California nuclear power plant.

The job was in a turbine building of Pacific Gas & Electric Co.'s Diablo Canyon plant near here. The work was complicated by the size of the 30- to 60-ton units and the need to move them through a maze of piping, columns, and other obstacles on several floors of lightweight construction.

Several methods of moving the heat exchangers were studied before Sheedy Co., San Francisco, Calif., devised a hydraulically equalized jacking and skidding system.

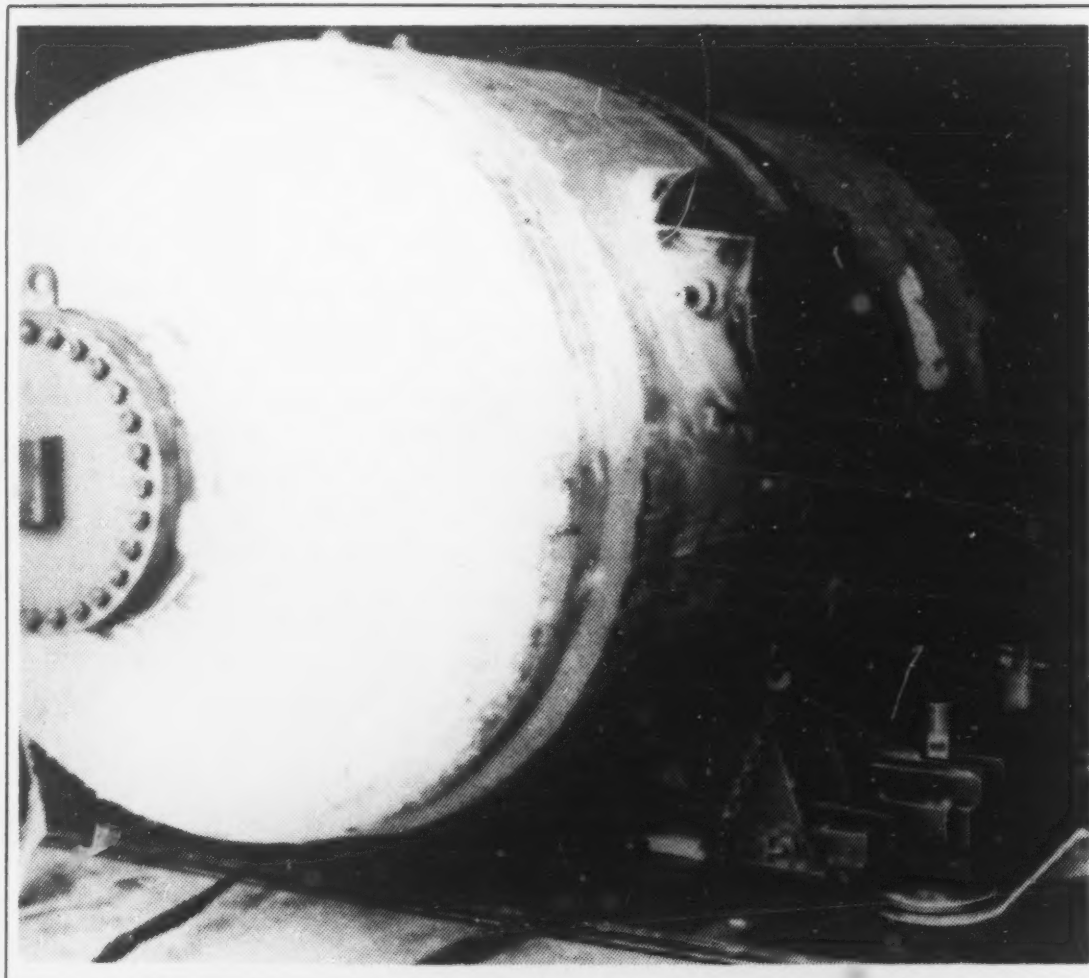
The system ensured that weight of the units would be distributed over floors and not exceed permissible load limits. It also permitted raising and lowering the heat exchangers off support saddles and on and off concrete slabs.

Special fixtures were designed to cradle and skid the heat exchangers and to contain the hydraulic rams used for jacking. Forty-five 15-ton rams and three electric/hydraulic pumps from Power Team Products were used in the process. Sheedy also developed a manifold system to control ram pressure and equalize load distribution over eight support points. One 10,000-psi hydraulic pump powered all of the rams under each heat exchanger.

Skidding shoes at the bases of the support fixtures were fitted with "Teflon" pads or clusters of ball transfers that could be interchanged, depending on load conditions and floor surfaces.

Before the move, Sheedy designed a vehicle to test all equipment and train personnel to operate the jacking gear. Various lubricants were tested to help ease sliding the heat exchangers. A laundry detergent was chosen as the most effective.

Movement paths were mapped, taking into account floors and beam and column arrangements,



THIRTY-ONE HEAT exchangers were carefully removed from the utility plant.

over which the heat exchangers would be moved. Shoring and reinforcing of some beams and girders was required.

With towing winches and other special equipment, the heat exchangers were moved to access openings on various levels of the

building, where they were rigged and lowered to the ground by cranes.

The heat exchangers were removed and new ones installed within the 42 days allotted by the utility during the shutdown.

Design changes can boost energy efficiency

GAITHERSBURG, Md. — Controlling airflow around lights, increasing mass in floors, and adding carpeting are some basic design features for more energy-efficient buildings that could result in savings of millions of dollars annually, says the National Institute of Standards and Technology (NIST).

Currently, more than \$40 billion is spent yearly to light commercial buildings in the United States. It costs another \$10 billion for cooling to remove the heat generated

by lights.

"If we can better understand how lighting, heating, and cooling systems interact, and we can evaluate and predict that synergy, then these systems can be designed to operate more efficiently, saving energy," says James E. Hill, chief of the NIST Building Environment Division.

NIST researchers are using a specially designed, computer-controlled test room to make detailed measurements of lighting power, cooling load, air and light-

ing fixture temperatures, light levels, and heat flow.

During a test, about 400 measurements are taken every two minutes of various types of lighting, hvac systems, and test room configurations.

Researchers say that they have found that, by carefully designing the way air flows around the lighting system, lamp temperature can be kept at its most energy-efficient level.

They say that most of the heat from lighting is stored in the ple-

num — the area between a suspended ceiling and ceiling slab — and floor slabs. The researchers found that by adding return air ducts in the plenum, adding carpeting on the floor, and doubling the floor mass increased heat storage and reduced the peak cooling load.

In future tests, the researchers will use a solar simulator to determine what effect heat gain through exterior walls has on lighting and hvac system performance.

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The Audit Bureau

STATISTICAL PANORAMA

FORECASTS

Air conditioning — Three hot summers in a row is too much to expect. But momentum and 1.4 million replacements will keep unitary shipments within 5% of last year, or 3,830,000 units.

Heat pumps — With homebuilding in the South stabilizing and replacements strong, heat pump shipments should drop only 4% this year to 798,000 units.

Furnaces — Total gas, oil, and electric furnace shipments in 1989, at 2,560,600 units, will be almost even with last year's mark. The biggest weakness: electric furnaces.

Boilers — Despite a softening in Northeast home construction, replacements will keep gas and oil boiler shipments even this year at 367,500 units. Commercial boilers will be up slightly.

Chillers — Domestic orders continue to reflect a weak large commercial construction market. Exports, however, show no sign of slackening. Look for a 5% increase this year to 15,000 units.

Room air conditioners — Last summer's heat waves wiped out room unit inventories despite increased imports. The 14% decline this year, to 4 million units, reflects normal summer demand.

Commercial refrigeration — This market, steady in good times and bad, will be up 3% again this year to 115,000 units. Increasing emphasis is being placed on supermarket remodels.

Housing — Rising interest rates and regional multifamily overbuilding will mean an 11% decline in home starts this year to 1,325,000 units. Single-family starts will slip below 1 million for the first time since 1982.

Replacements — This market segment, which accounts for more than half of comfort heating-cooling shipments, will flatten in 1989. The culprit: higher short-term interest rates.

Finding the details . . .

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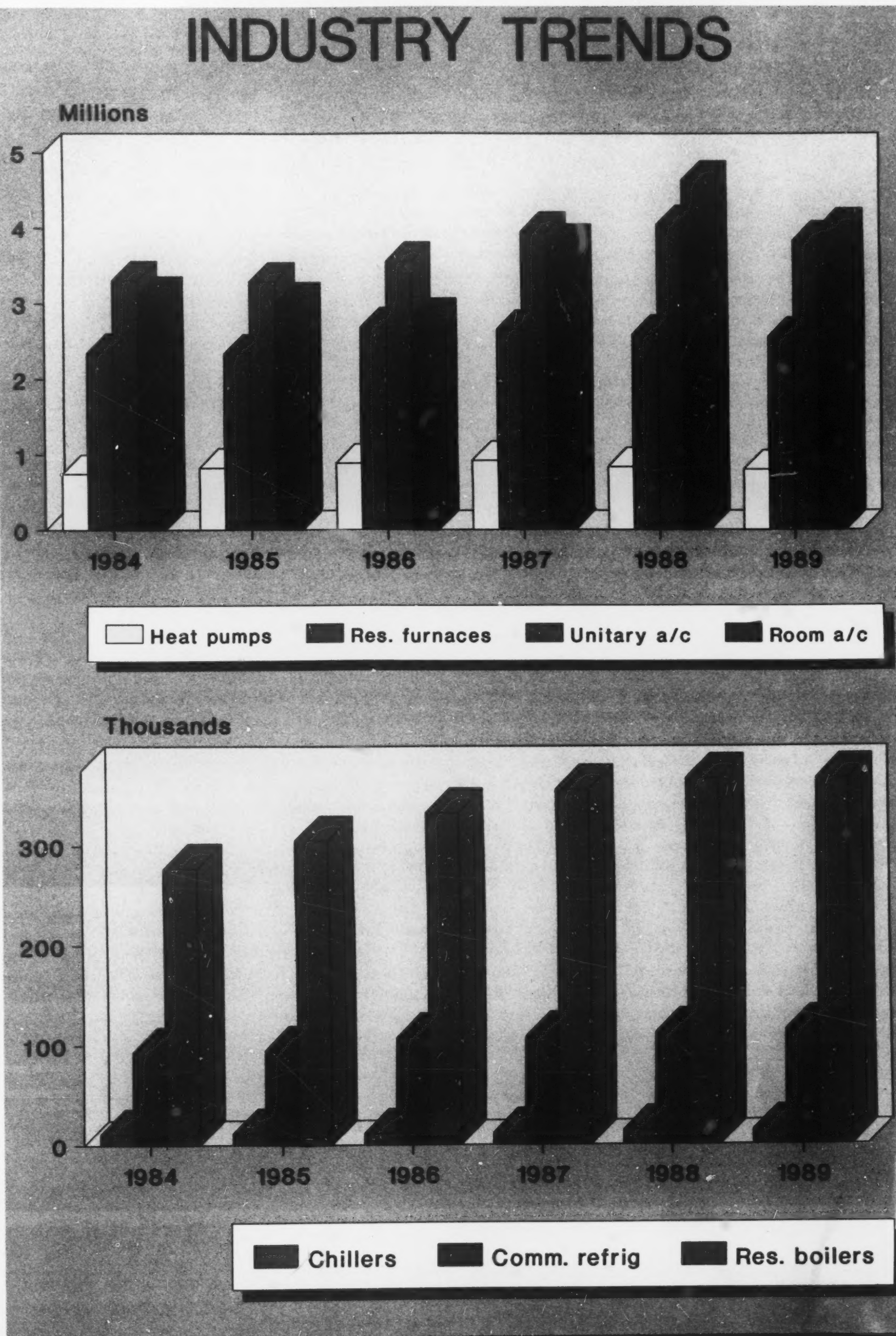
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AIR CONDITIONING

Hot summer pushes unitary to record of 4-million units

For four consecutive years, 1984 through 1987, the industry posted unitary totals of more than 3 million units. Three of those years set records. Shipments averaged more than 3.5 million units. Then along came 1988 and successive heat waves that pushed through the Midwest and Northeast.

For a market already buoyed up by burgeoning replacements and only slightly diminished by new construction, last summer's heat waves pushed unitary shipments past the 4-million mark for the first time. It was another new record that was made even brighter by inventory reductions.

Total shipments of U.S. unitary air conditioners (including air-to-air heat pumps) in 1988 increased by 2.4% to a new record total of 4,049,212 units, according to the Air-Conditioning and Refrigeration Institute (ARI). The 1987 total, the previous record, was 3,955,064 units.

The losses in new home starts, almost equally divided between air conditioners and heat pumps, were more than compensated for by the 20% increase in air conditioner replacements last year. Central air conditioner replacements in 1988 totaled 1.4 million units, or 53% of shipments, according to *News* estimates. Also prompted by the hot summer, add-on's were up 17% to 400,000 units.

Looking ahead, the industry has no right to expect a third hot summer in a row. It's also faced with a probable 10% decline in new home starts. Even so, our forecast for 3,830,000 unitary shipments

this year represents only a 5.4% drop from the heady heights of 1988.

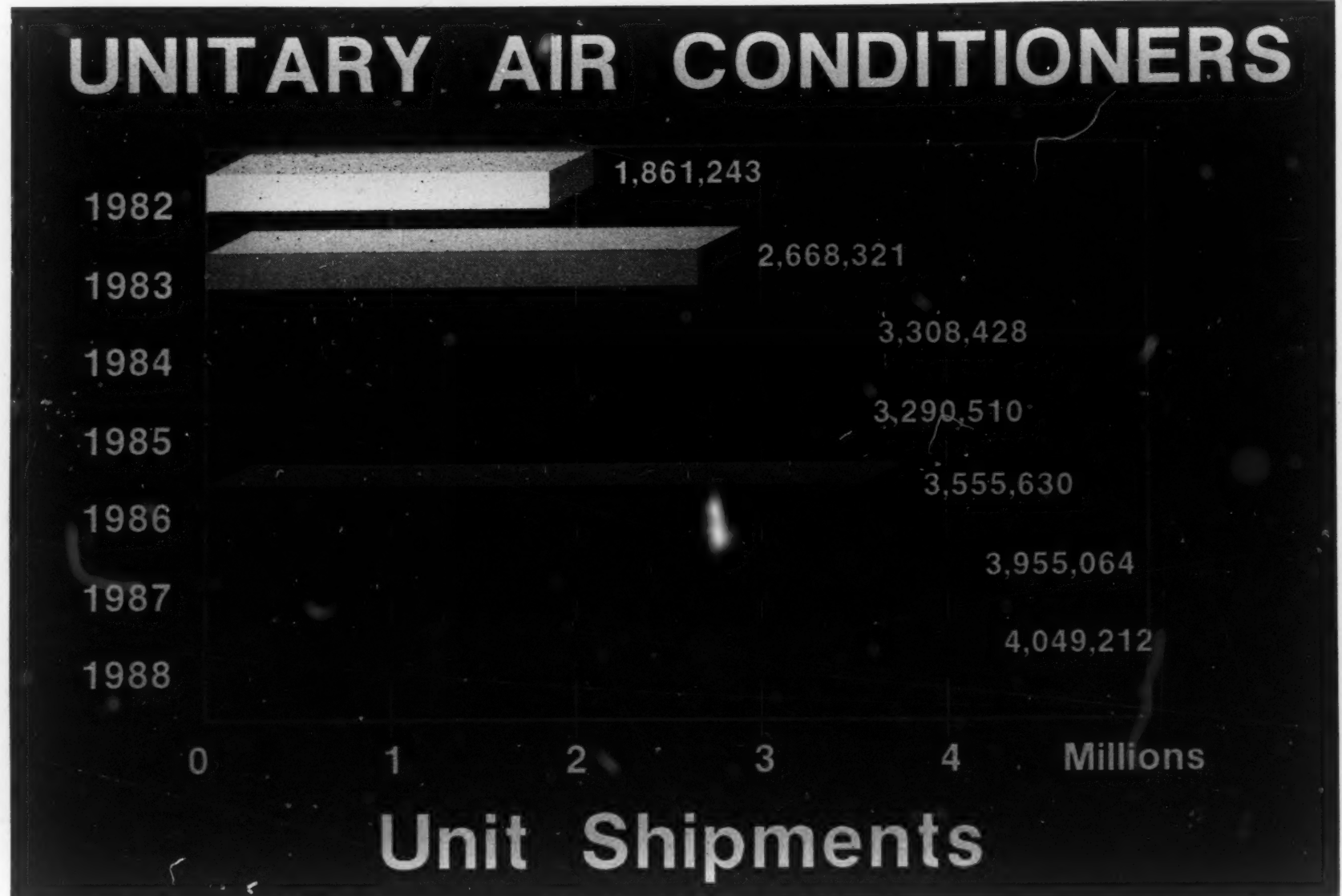
These figures do not include air conditioning units and air-to-air heat pumps shipped to foreign markets. Exports of U.S. unitary air conditioners in 1988 totaled 226,000 units, up a whopping 72.3% from the 131,174 units exported in the previous year. The 1987 total reflected a 69% increase from the previous year's performance.

It should be remembered that these export figures include only those units shipped directly to foreign destinations by oem's (original equipment manufacturers) and include few, if any, units shipped by distributors and contractors.

Of the 3,955,064 unitary air conditioners shipped in 1987, ARI reported that 82.2% — or 3,251,063 units — were for residential applications and 17.8% — or 704,001 units — were for commercial applications.

That ratio has been almost the same since 1985 and contrasts with the 78%-22% split that held sway through the 1970's and early 1980's. It's much different from the ratio posted in 1952, the first year these data were available, when 66.9% of unitary equipment went into commercial applications and only 33.1% went into homes.

If we accept that the 1987 split was carried forward into 1988, then 3,328,452 units — or 82.2% of the 4,049,212-unit total — were destined for residential applications and 720,760 units — or



17.8% — were commercial units.

The unitary category includes electric air conditioners, gas air conditioners, air-to-air heat pumps, and rooftop equipment. It does not include packaged terminal air conditioners (ptac's) and packaged terminal heat pumps (pthp's), room air conditioners and heat pumps, heat pump water heaters (air-to-water heat pumps), or water-source heat pumps.

The inventory of unitary air conditioners at the end of 1988 totaled 1,016,232 units, down 162,000 units or 13.8% from the 1,178,210 units in inventory at the end of 1987. As a percentage of total shipments, the 25.1% at the end of

last year was 4.7% less than the 29.8% posted a year earlier.

Until last year, inventory levels had increased gradually from a low of 24.3% of shipments in 1984. However, the ratio never quite reached the 30% to 33% range considered normal for much of the industry's history. The decline in inventory in 1988 was blamed almost wholly on hot weather that lasted late into the season and brought about shortages in the most popular equipment sizes.

Surveys by *The News* also have confirmed major improvements in distribution efficiency among both independent wholesaler-distributors and factory branches. Forecasting programs by both major wholesaler groups have had a significant impact. And improved manufacturing techniques have enabled several oem's to both improve delivery times and reduce inventories.

Of the total inventory at the end of 1988, some 421,925 units — or 41.5% — were at the factory and 594,307 units — or 58.5% — were at the distributor level. This represents nearly a 2% shift toward field inventories last year and is in sharp contrast to the 49%-51% split in favor of distributors at the end of 1983.

Home start slide costs heat pumps

Heat pumps took it on the chin in 1988. A drop in housing starts, particularly in its South bastion, a related decline in new-home penetration rate, and a marginal drop in replacement sales produced a triple combination.

Shipments of air-to-air heat pumps in 1988 totaled 834,606 units, a decline of 9.1% from the record high of 918,432 units shipped in 1987, according to ARI.

The reasons for the decline were many for this product, which relies for more than two thirds of its volume on the new construction market. The 10.9% drop in national housing starts in 1988 was underlined by a 9.3% decline in starts in the South, the heat pump's prime market.

Heat pump penetration in the new single-family home market slipped from 27.3% to 26% last year, primarily because of penetration losses in the Midwest and West. And replacement-modernization sales, which produced a 30% gain in 1987, fell off marginally (2.3%) last year.

Technological improvements also are playing a role. In 1988, for the first time, the average efficiency for all residential heat pumps shipped edged above that of central air conditioners. Variable-speed drives, microprocessors, and scroll compressors promise to make heat pumps more attractive outside of the South.

A growing number of merchandising contractors in areas where utilities offer rebates for high efficiency already are selling heat pumps as replacements for worn-out central air conditioners even though the homeowner has a gas- or oil-fired furnace. The incremental cost, with the rebate, usually is small and the homeowner saves on operating cost in the spring and

The succession of heat waves did not help appreciably because the brunt of the exceptionally hot weather fell outside of the heat pump's principal markets. Despite these setbacks, prospects for the air-to-air heat pump remain bright. Housing starts in the South are expected to hit bottom this year and, in mid-1989 and beyond, should increase moderately. This should bring about increased heat pump shipments and new home market penetration.

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(Page 8, Please)

Our unofficial estimates of unitary market shares

When it comes to figuring shares of the unitary air conditioning market held by individual manufacturers, we must depend on "feel" rather than reliable numbers. There are no reliable numbers.

Each year the percentages shift as companies enter or leave the market, as one company is acquired by another, or distribution and product improvements are reflected in the marketplace.

In the past year, for example, *The News* reported more than 60 mergers, acquisitions, or spinoffs involving almost twice that number of companies directly involved in this industry. There were more than 80 in each of the two previous years. What's more, we're not confident that even those lists are complete.

It must be remembered that, like all national totals, our estimates of market share seldom will provide an accurate picture of what is happening in any specific city or area of the country.

Some essentially regional manufacturers, with a small national market share, often are among the leaders in the areas where their distribution is concentrated.

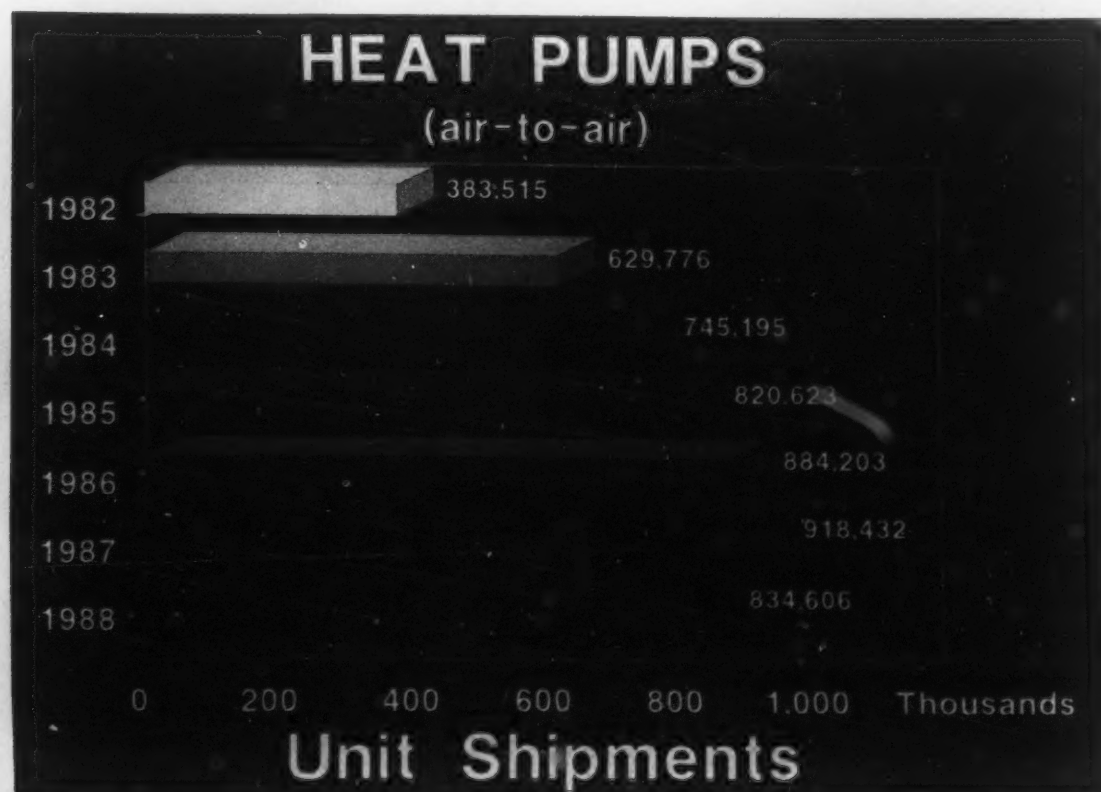
Another distortion comes from the interest of the reader. Whether

a particular manufacturer is strong in new construction, add-on, or replacement sales makes little difference to many. But for contractors that specialize, the list of competitive brands can expand or contract according to that specialty. It can also change when the contractor's interest changes.

Because of these and other situations within their own cities, contractors often get a distorted view of national market shares.

For them, and for market researchers not deeply involved with the air conditioning industry, *The News* offers these educated guesses of unitary equipment market share in terms of units shipped:

- Carrier (including Bryant, Day & Night, and Payne) — 24%.
- Rheem-Ruud — 14%.
- Lennox (including Armstrong, Johnson, Air Ease) — 14%.
- Trane — 11%.
- Heil-Quaker (including Tempstar) — 9%.
- SnyderGeneral (including Arcoaire and Comfortmaker) — 8%.
- Central Environmental Systems, York International — 8%.
- Goodman (Janitrol) — 5%.
- All others — 7%.



AIR CONDITIONING

(Continued from Page 6)

fall.

For the record, heat pump inventory at the end of 1988 totaled 283,000 units, down 17.2% from the 341,600 heat pumps in inventory at the end of 1987. The 1988 total represented 33.9% of shipments, down from 37.2% a year earlier.

Of the 1988 total, 118,000 units, or 41.7%, were at the factory and 165,000 units, or 58.3%, were at distributors. In the previous year, 44.6% of the inventory was at the factory and 55.4% was in the field.

Looking ahead, we expect heat pump shipments this year to total 797,700 units, a decline of 4.4% or less than 50,000 units below the average for the previous five years.

Meanwhile, in the wings, the gas industry continues its development of gas-fired heat pump prototypes and a consortium of Japanese companies continues its work on gas engine-drive technology. Efficiency improvements are expected to continue as the industry moves toward mandatory federal efficiency minimums in 1992.

Capacity mix

An indication of capacity mix for 1988 unitary air conditioners and how it compared with 1972's experience follows:

	%	%
	1972	1988
Under 1.8 ton	16	8.6
1.8 ton to 26,999 Btuh	23	20.4
2.25 ton to 32,999 Btuh	17	19.8
2.75 ton to 38,999 Btuh	22	22.8
3.25 ton to 43,999 Btuh	6	7.7
3.67 ton to 53,999 Btuh	7	8.5
4.5 ton to 64,999 Btuh	6	8.0
5.4 ton to 96,999 Btuh	1	1.7
8.1 ton and larger	1	2.5

Installed value

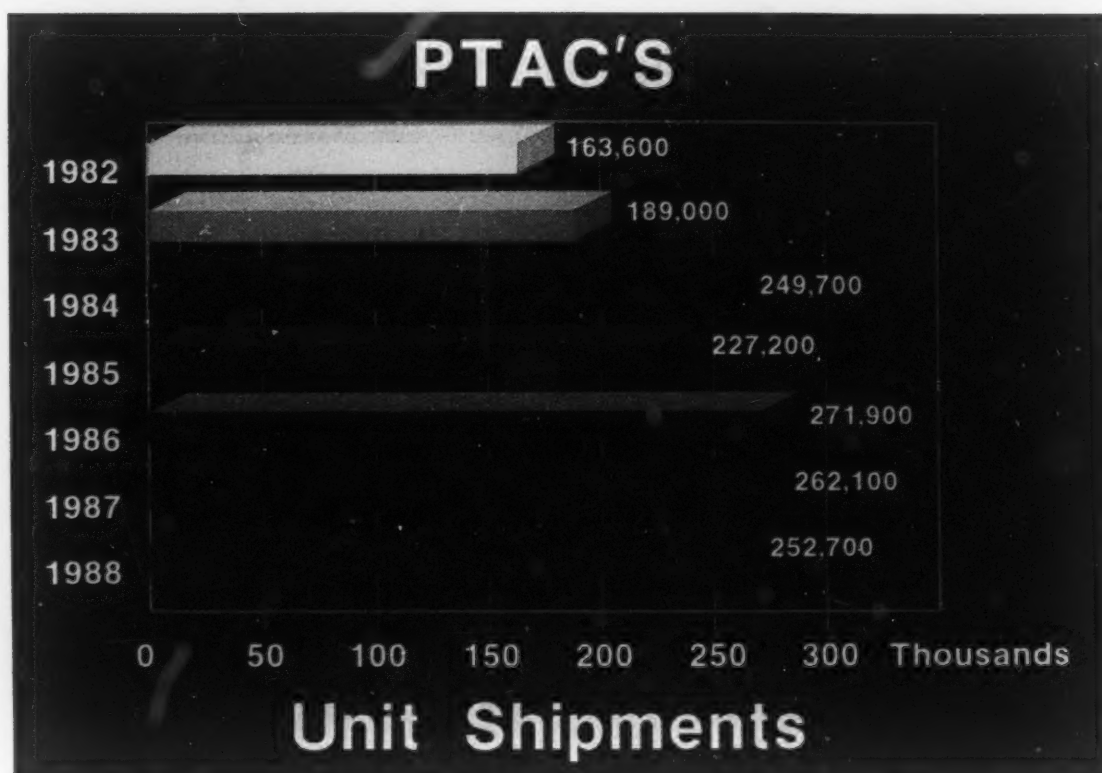
The installed value of both unitary and field-engineered air conditioning systems put in place in 1987, the latest year for which these figures are available, was \$17,231,742,000, up 5.1% from the previous year's total of \$16,392,006,000. The \$17.2-billion total covers all comfort cooling systems, with the exception of room air conditioners, installed in the U.S. in 1987.

The installed value of unitary air conditioning equipment put in place in 1987 was \$11,010,484,000, an increase of 12.4% from the \$9,795,592,000 total posted in 1986, according to ARI's Business Research Department.

Of the total, ARI estimated that the value of commercial unitary installations in 1987 was \$3,611,955,000, an increase of 6.5% from the prior-year total of \$3,392,937,000. The total value of residential installations was \$7,398,530,000 in 1987, up 15.6% from \$6,402,655,000 in the previous year.

Commercial systems in 1987 accounted for 17.2% of units but 32.8% of installation dollars. Similarly, residential installations accounted for 82.8% of the units shipped in that year but only 67.2% of the installation dollars.

Installed value covers the cost of unitary air conditioning equipment as shipped from the factory together with labor, ductwork, registers and grilles, thermostatic



and other controls, electrical wiring, and other components of the system installed by contractors.

The installed value of field-engineered systems put in place in 1987 was \$6,221,258,000, down 5.7% from the total of \$6,596,414,000 for the previous year. It should be remembered that, while the increase in 1986 was only 1.2%, the previous year's increase was 22.9%.

In determining the installed value of field-engineered air conditioning systems, ARI estimates that only 7.5% of the installed cost of the system is represented by the cost of the refrigerating machine. The remaining 92.5% represents air-handling equipment, labor, ducts, pipes, valves, pumps, controls, and all other installation costs.

Ptac's

Packaged terminal air conditioners continued to do reasonably well in a soft market last year. Shipments in 1988 totaled 252,700 units, down only 3.6% from the prior-year total of 262,100 units. The decline in 1987 also was 3.6% from the 1986 record total of 271,900 units.

This product is used extensively in hotel-motel, nursing home, and suburban office park applications. All of these markets have held up well in the face of overall commercial office building declines.

Ptacs compete head-on with commercial rooftops in the lower-tonnage ranges, and with field-engineered central systems in office buildings and hospitals. Heat pump versions, known as packaged terminal heat pumps (pthp's), captured 45% of the 1988 total, the same as the previous year. Heat pump versions accounted for 52% of that market in 1986.

The Bureau of the Census reported that a total of 245,136 ptacs were shipped in 1987, the latest year for which these data are available, down 2.3% from the 1986 total of 251,575 units. Of the total shipped in 1987, some 107,277 units, or 43.7%, were pthp's. In 1986, the 103,970 pthp's accounted for 42% of the total.

Water-source heat pumps

Shipments of water-source heat pumps, which have tripled in little more than a decade, totaled 126,100 units in 1988, down 8.8% from the previous year's total of 138,500 units.

Two types of these units serve different markets. The older segment uses closed loops tied to a small boiler and cooling tower or

evaporative condenser to maintain a loop water temperature between 60° and 90°F. They take advantage of load diversity and usually are applied in high-rise apartments and condominiums and in small- and medium-sized office buildings.

The other group initially used water from a pond, a well, or the ocean at temperatures as low as 45° and were largely confined to rural or exurban areas. In recent years, however, the market has swung sharply toward vertical or horizontal underground water-glycol loops to provide comfort heating and cooling at high efficiencies.

Most are water-to-air units although a few are water-to-water units. They do not have to depend on the quantity or quality of the ground water available at the site. Pumping costs are reduced, defrost cycles are eliminated, and they can eliminate back-up heat provisions if sized for the design heat load. They also can be applied on small lots in urban areas.

Most, although not all, of these systems are applied in single-family homes. They do, however, have a comparatively high first cost and require specialized application knowledge — factors that are likely to limit these systems to steady, but unspectacular, growth.

Heat pump water heaters

Domestic hot water in U.S. homes traditionally has been heated in gas-fired and electric resistance storage tanks. A few use oil burners. Desuperheaters on air conditioners and heat pumps help in the South. And, in the Northeast and Midwest, some use water jackets on gas- and oil-fired boilers.

Instantaneous hot water heaters of the type popular in Europe and the Far East so far have made little impression on the North American market, with the possible exception of motels. Instead, increased energy prices have motivated homeowners to add extra insulation to storage tanks, and to add solar assist and desuperheaters.

The air-to-water heat pump, with an installed cost more than double that of an electric resistance-heated storage tank, entered the market a decade ago with the promise of saving up to 40% in operating costs. Instead of capturing a big chunk of the 7 million annual water heater market, today's heat pump water heater market probably is less than 10,000 units.

A relatively new product called an integrated appliance already is carving a niche for itself that grows larger each year. There are no figures for these systems yet but there is no doubt their numbers are growing rapidly from a small base.

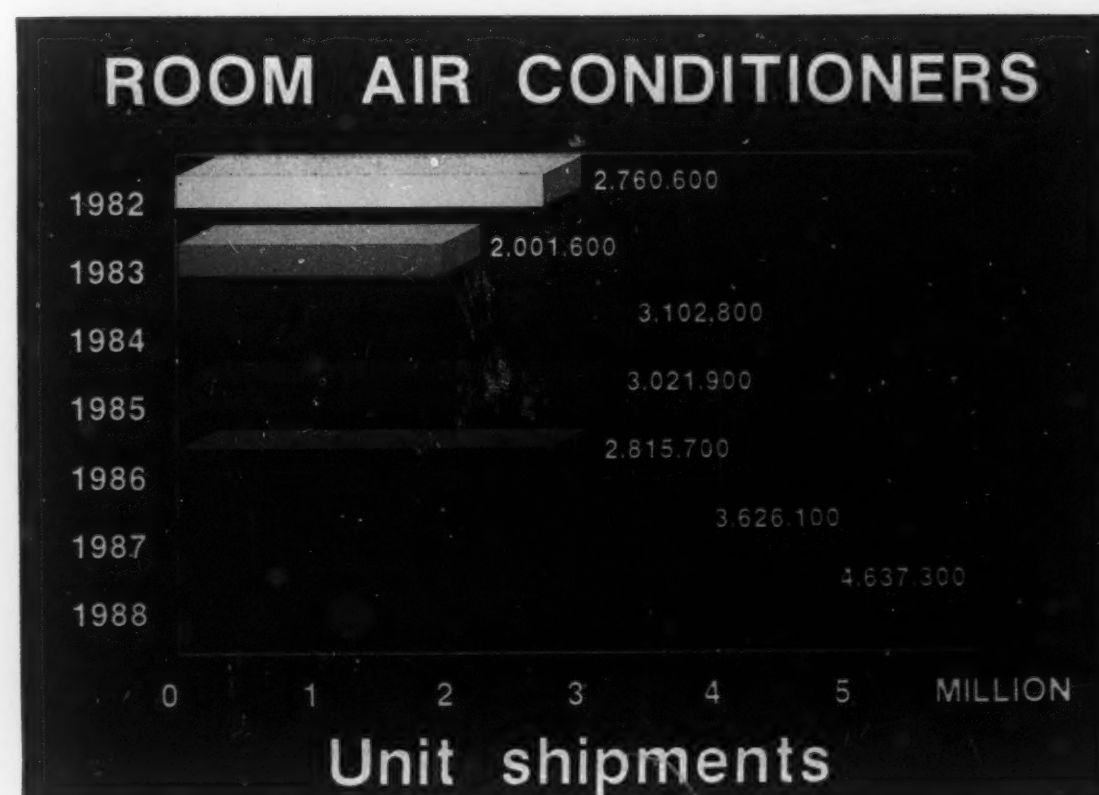
These appliances use a conventional gas-fired domestic hot water storage heater piped to a water coil in a separate air handler. Electric water heaters don't have a recovery rate fast enough for these systems.

The air handler, which can also house a split-system air conditioner evaporator or heat pump indoor unit, uses the domestic hot water for space heating. It saves on overall fuel bills by using much of what had been hot water stor-

age losses. Special fittings on the storage tank keep plumbing and air conditioning technicians from becoming involved in each other's trade.

These systems are being used in both single-family and multifamily homes. The market is being promoted by many gas utilities who see it as a way back into the apartment and condominium markets after being largely shut out by the trend toward individual tenant metering.

Hydronics manufacturers also are offering an integrated boiler and domestic hot water heater that improves overall space and hot water heating efficiencies. This system, however, does not provide for comfort cooling.



1988 room unit year best ever

A series of heat waves that rolled over the Midwest and Northeast last summer for the second year in a row cleaned out room air conditioner inventories almost to the bare walls. It was the best year ever for room units, if not for U.S. room unit manufacturers.

Shipments of room air conditioners made in the U.S. last year totaled 4,637,300 units, an increase of 27.8% over the 3,628,100 units shipped in 1987, according to the Association of Home Appliance Manufacturers (AHAM).

That, however, is only part of the story.

For the first 11 months of 1988, room unit imports into the United States totaled 956,127 units worth \$215.8 million, a 41% increase over the 678,575 room units imported during the same period in 1987. In all of 1984, the U.S. imported only 141,731 room units.

The changing value of the dollar in relation to the yen reduced Japanese room unit imports to less than 5% last year. But other major suppliers have sprung up. The U.S. imported 244,000 room units from South Korea and from Singapore during the first 11 months of 1988, another 225,000 from Brazil (site of Carrier's room unit operation), 131,000 from Malaysia, and 69,600 from Canada.

Meanwhile, U.S. room unit exports totaled only 216,970 units during the first 11 months of 1988, or 4.7% of domestic production. A

decade ago, the U.S. exported about 25% of production.

If we add 1988 U.S. production and imports together, we see that the total was nearly 5,600,000 units when we count only 11 months of imports. The best year ever for room unit shipments was in 1970, when 5,886,000 U.S. room units were shipped.

In November, 1988, AHAM's members forecast that 1989 shipments would total 3,750,000 units, a decline of 19% from the previous year.

That forecast is not nearly as conservative as it first appears. On the positive side, field and factory inventories at the end of last summer were practically zero. Manufacturers will have to build for both this summer's sales and to fill a badly depleted pipeline.

On the negative side, the supply of rotary compressors used in room units is tight. Room units are primarily impulse purchases sparked by hot weather. They are marketed principally by appliance and department stores. Only about 5% of room units are sold by contractors.

For U.S. room unit shipments to exceed 4 million units this year, we would need another unseasonably hot summer. It's possible. Probability is another matter. The News expects room unit shipments to total about 4 million units in 1989, given the continuing pres-

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AIR CONDITIONING

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sure from imports and the vagaries of the weather.

For the record, the Bureau of the Census reported that 2,721,745 room air conditioners were shipped in 1987, the latest year for which these data are available. That represented a 10.9% decline from the 2,721,745 room units the Bureau said were shipped in 1986.

Chillers

Even though the office building and institutional markets were soft last year, that weakness was more than compensated for by exports of U.S. chillers. Total shipments of chillers in 1988 amounted to 14,330 units, an increase of 16.8% over the number shipped in the previous year.

After two even years, shipments of centrifugal chillers last year increased by 18.9% to 4,400 units. The previous totals were 3,700 units. More than 1,000 of those centrifugals, however, were exported.

It should be noted that the totals since 1985 do not include open-type centrifugals. In the past, we have speculated that open centrifugals account for 400 to 500 domestic market units.

Reciprocating chillers shipped in 1988 totaled 9,800 units, an increase of 16.1% from the previous year's total of 8,440 units. Here again, exports last year accounted for more than 2,000 reciprocating chiller packages. The market for absorption chillers, at 130 units last year, was up 2.4% from the 127 units shipped in 1987.

The U.S. market for chillers, an essential ingredient in field-erected air conditioning systems, has been hampered by an overbuilt office building market in much of the country. As evidenced

by this year's figures, the hard dollar of past years that forced manufacturers to build much of their 50-Hz equipment abroad has softened and export shipments have increased.

At the end of 1988, bookings for large-tonnage liquid chillers were up 5% when compared to December, 1987. Similarly, bookings for reciprocating liquid chillers were up 31% over the same period a year earlier.

The domestic institutional new construction market has continued strong and replacements have been capturing an increasing market share. Too, there is a trend toward using more chillers in a given installation in order to achieve better capacity control and operating economy. Fears about the availability of CFC-11 and CFC-12 in the face of this year's freeze and future cutbacks have not materially influenced owners to specify HCFC-22 or other alternatives.

For the record, the Bureau of the Census reported that 3,726 centrifugal chillers were shipped in 1987, the latest year for which these data are available, down 4.5% from the 3,903 centrifugals reported shipped in 1986. These totals do not include open-type units.

The Bureau reported that 12,665

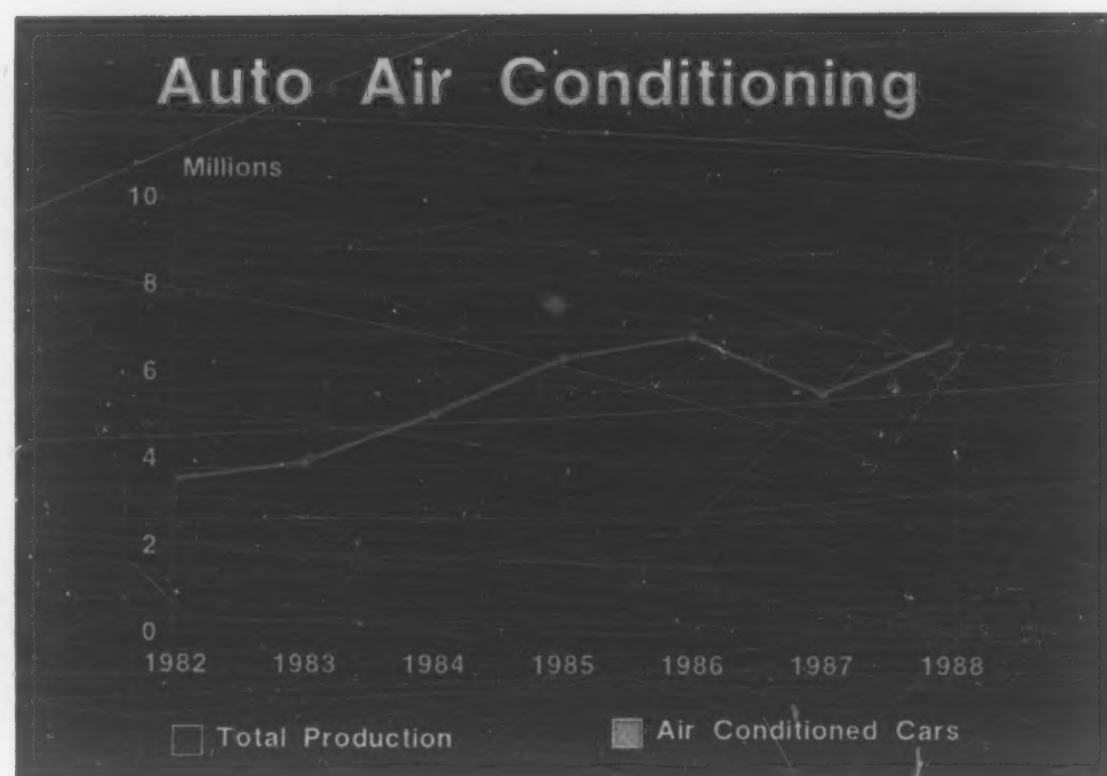
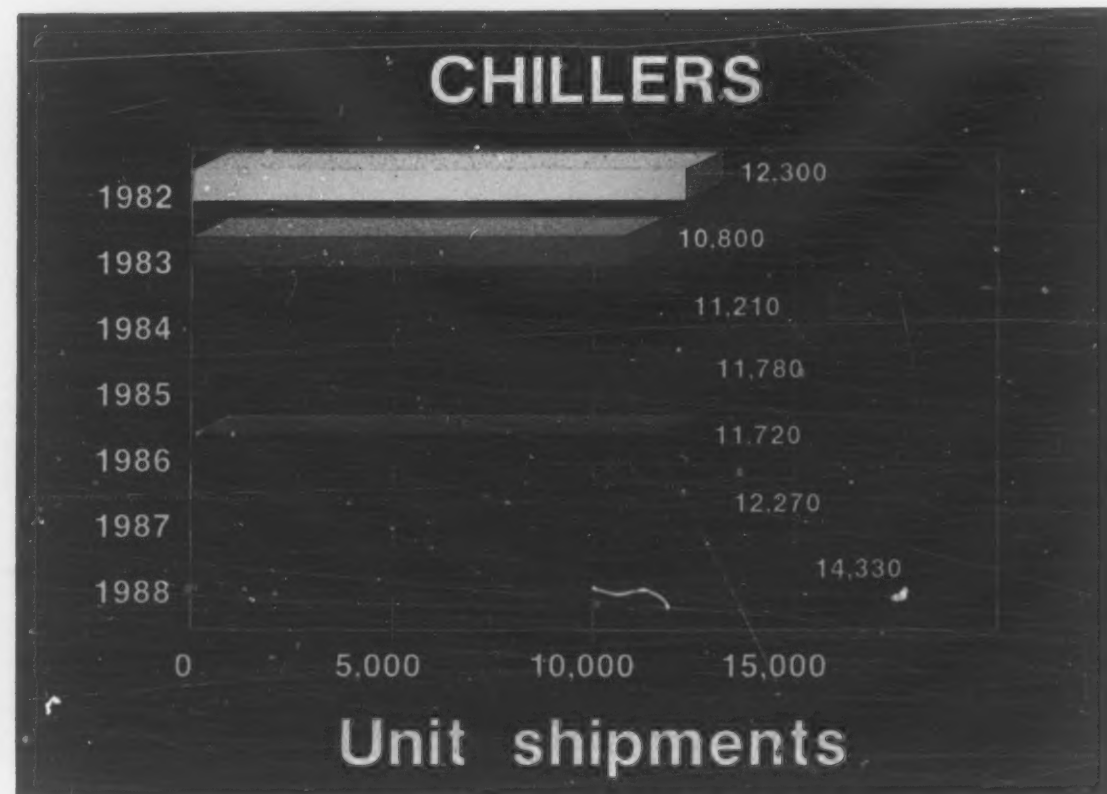
reciprocating chillers were shipped in 1987, up 0.5% from the 12,604 shipped in the previous year. Shipment figures for absorption chillers were not provided so that market shares of individual manufacturers would not be revealed.

Year	Recip.	Cent.	Abs.
1970	10,300	4,150	1,000
1971	10,000	4,000	900
1972	10,000	3,000	900
1973	10,400	4,100	800
1974	11,000	4,500	1,000
1975	8,250	4,950	700
1976	7,600	3,400	500
1977	8,900	3,000	450
1978	8,100	3,350	370
1979	8,100	3,350	280
1980	9,650	4,600	280
1981	9,250	4,300	240
1982	8,500	3,600	200
1983	7,500	3,100	140
1984	8,100	2,950	160
1985	8,160	3,490	130
1986	7,800	3,700	160
1987	8,440	3,700	130
1988	9,800	4,400	130

90% of autos air conditioned

According to Ward's Automotive Reports, there were 7,066,056 air conditioning units installed on U.S. domestic automobiles in the 1988 model year, up 7.5% from the 6,570,732 factory air installations made in the 1987 model year.

The performance of factory air installations was better than that of the domestic auto industry as a whole. U.S. domestic auto production in the 1988 model year totaled 7,825,586 units, an increase of 1.5% over the 7,707,287 cars



Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

produced in the previous model year.

The difference was reflected in an increase in factory air penetra-

tion rates from 85.25% in the 1987 model year to 90.3% last year.

Of cars made in the U.S., almost (Page 14, Please)

Replacements help rooftops build on a strong market

Even though there was a dip in light commercial new construction last year, replacements and a carryover from strong housing years helped shipments of commercial rooftops maintain an upward spiral.

According to our calculations, commercial rooftop shipments in 1988 totaled 170,600 units, an increase of 7.8% over the previous year's total of 158,200 units.

Shopping center and other light

commercial and industrial construction tends to follow closely behind the housing market. The losses in housing over the past two years, however, have been more than compensated for by Mother Nature in the form of heat waves.

The replacement market already was strong, perhaps 45% of total shipments in 1986. Not only are the rooftops installed in the 1960's and 1970's inefficient by today's standards, many of them are

simply worn out.

The replacement market was helped in both 1987 and 1988 by a succession of heat waves that rolled over the Midwest and Northeast. The sustained hot weather brought the prospect of major repair bills for some. And for others, high utility bills had the same effect — replace the old with new equipment.

Commercial rooftops really represent a market application of several different products rather than a specific product type that can be identified statistically.

For example, all-year units are identified by both ARI and the Bureau of the Census and clearly imply a heating capability. However, both single-package and split-system rooftops — though they may have been shipped (and counted) as cooling-only units — may have a modular heating section added in the field.

Too, heat pumps imply one, and usually two, methods of heating in addition to their cooling capability. Another complicating factor is that small, all-year rooftops are applied in more residential than commercial situations.

The News bases its assessment

of the commercial rooftop market on the known number of unitary shipments in 1988 and 1987 of 5.4 tons or more, and by past ARI and Bureau of the Census ratios of system types and sizes and residential-commercial applications.

Although not as up to date as we would like, the exercise does produce a breakdown within a few percentage points of the latest ARI reports that break down shipments by size.

We have arbitrarily selected 5.4 tons as the starting point for commercial rooftops. We readily admit, however, that there are many commercial units smaller than that, just as there are residential units larger than 5.4 tons. The line, however, had to be drawn somewhere.

By applying the known — and latest — 1987 Bureau of the Census ratios to the 1987 and 1988 ARI shipment figures, we find that there were 691,000 commercial units shipped in 1988, an increase of 2.6% over the 673,700 commercial units shipped in the previous year.

By applying ratios evident in the 1987 Census Bureau report, we also found that, in 1983:

- 154,200 were split systems, of which 39,700 were rooftops of more than 5.4 tons. The respective 1987 totals were 145,600 and 38,000.

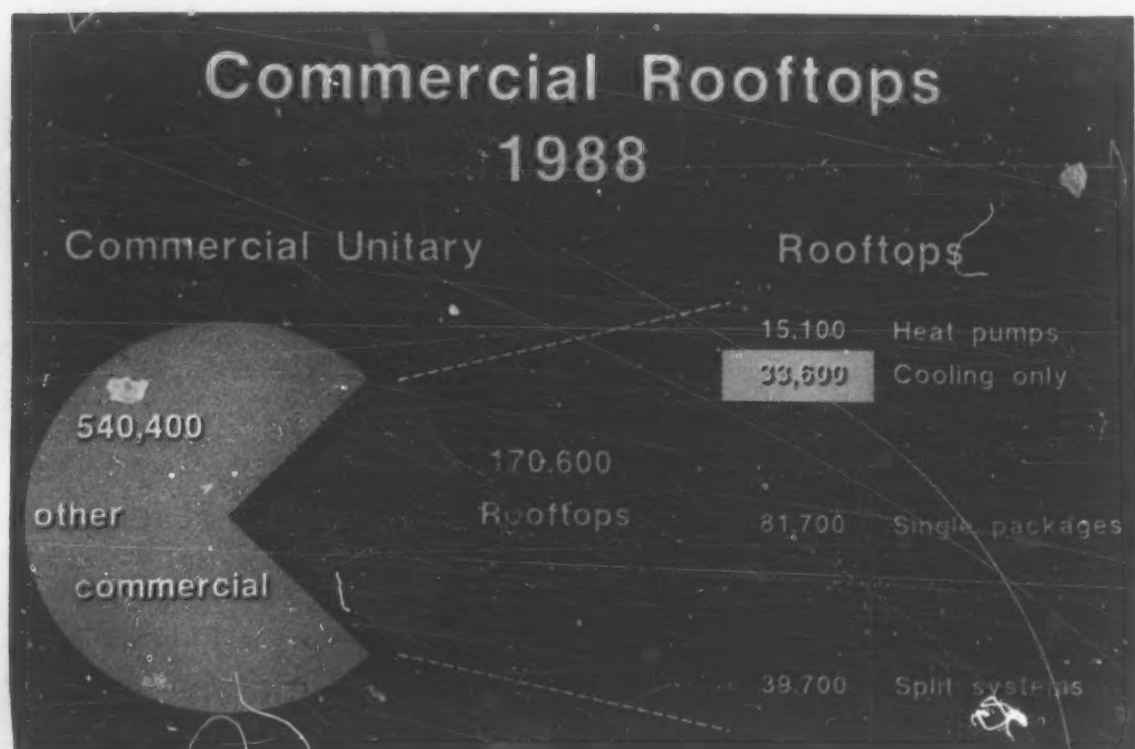
- 282,700 were all-year single packages, of which 81,700 were rooftops of more than 5.4 tons. The respective 1987 totals were 267,000 and 69,300.

- 128,400 were cooling-only air conditioners, of which 33,600 were rooftops of more than 5.4 tons. The respective 1987 totals were 121,300 and 31,700.

- 500 in both years were multi-zones, all of which had capacities in excess of 5.4 tons.

- 125,200 were heat pumps, of which 15,100 were rooftops of more than 5.4 tons. The respective 1987 totals were 139,300 and 18,700.

Taken together, 170,600 were commercial rooftops with capacities in excess of 5.4 tons. That leaves 520,400 commercial units with capacities of 5 tons or less. We know there are at least 100,000 three-phase units in that group, but further breakdowns in a segment so heavily weighted toward residential equipment are beyond our abilities.



AIR CONDITIONING

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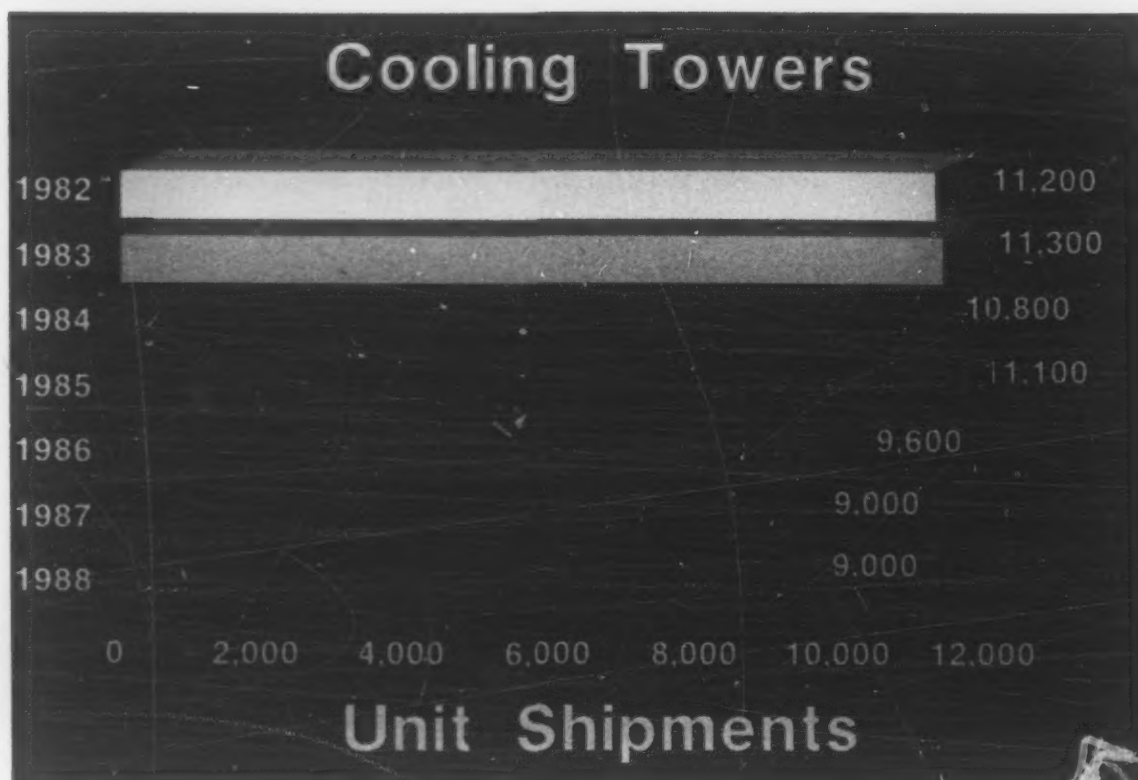
all luxury and full-size models feature factory air conditioning as standard equipment. The drop in 1987 model year air conditioning penetration was blamed on a competitive market. Many dealers ordered floor plans with a higher proportion of compact and subcompact cars stripped of expensive options so they could advertise lower prices.

Light trucks also demonstrated an improved appetite for air conditioning. *Ward's* reported that 2,979,863 light trucks produced in the U.S. during the 1988 model year were equipped with factory air conditioning, an increase of 23.3% over the 2,417,696 light trucks air conditioned in the 1987 model year.

The penetration of factory air conditioning in light trucks has increased steadily from 54.9% in 1983 to 61.3% in 1985 to 67.2% in 1987 to 71.3% in the last model year.

For the record, a total of 4,180,179 light trucks were produced in the U.S. during the 1988 model year, an increase of 16.2% from the 3,596,187 light trucks produced in the previous model year.

The Bureau of the Census did not report figures for mobile vehicle air conditioners in 1986 or 1987 because of the danger of revealing the market shares of the small number of manufacturers. In 1985, the latest year for which these data are available, the Bureau reported a shipment total of



13,008,516 units.

The Census Bureau did report that 213,626 recreational vehicle air conditioners were shipped in 1987, up 12.9% from the 177,842 units shipped in the previous year.

The aftermarket

There are no official figures for the auto air conditioning aftermarket, which declined steadily from 1978 through 1983 and then climbed back in step with the domestic auto industry after a wrenching series of shakeouts.

The International Mobile Air Conditioning Association (IMACA) estimates that the aftermarket has stabilized in recent years at about 750,000 units. The

agricultural and recreational vehicle markets have strengthened and, just as the aftermarket for light trucks was shifting to the factories, the medium-duty truck market has expanded for aftermarket manufacturers.

In recent years, aftermarket manufacturers have reported a significant surge in service and service parts.

Mindful of the July 1 production freeze on CFC-12, the refrigerant used for auto air conditioners, both factory and aftermarket executives are keeping a close eye on the development of alternatives.

Evaporative condensers

Shipments of evaporative con-

densers in 1987, the latest year for which these data are available, totaled 2,233 units, down 2.2% from the 2,282 units shipped in the previous year, according to the Bureau of the Census. Of the total, 30% were under 100 tons and 70% were over 100 tons.

Fancoil units

Shipments of fancoil units to U.S. markets in 1988 totaled 172,200 units, a decline of 8.7% from the 188,600-unit total for the previous year.

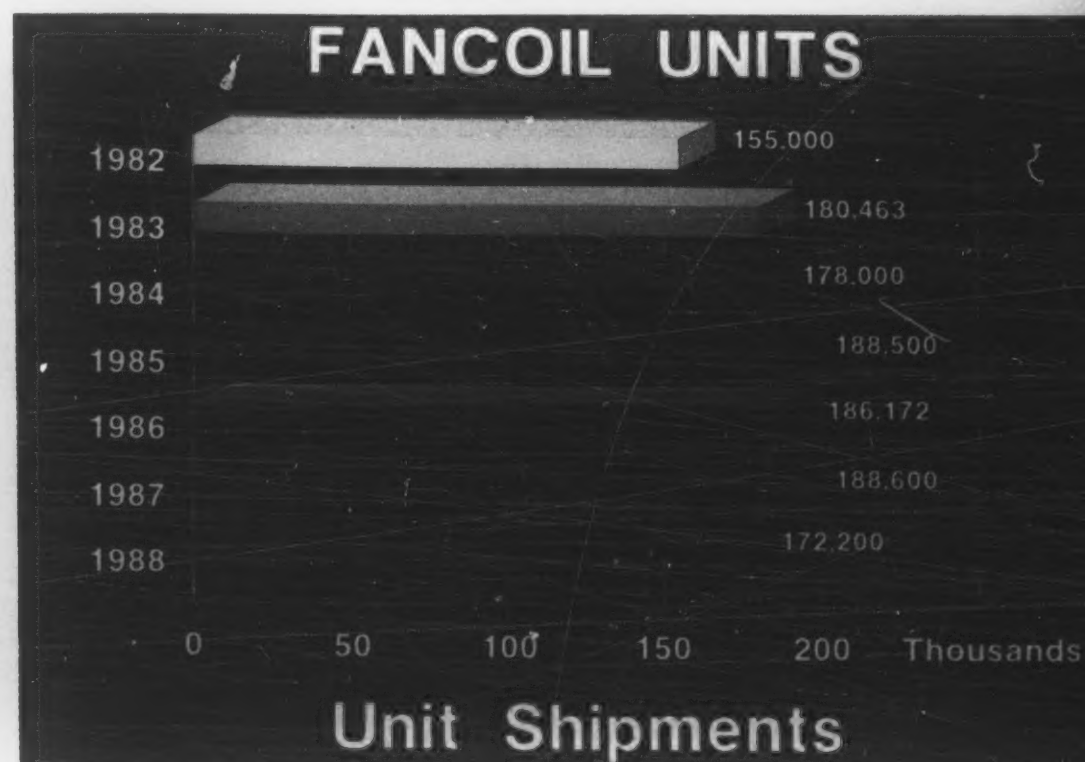
The Bureau of the Census reported that 228,342 fancoil units were shipped in 1987, the latest year for which these data are available, an increase of 11% over

the 205,731 units the Bureau said were shipped in 1986. The Bureau's figures include exports.

Of the units shipped in 1987, some 8% were vertical stack units, 48.8% were vertical units, and 43.2% were horizontal units.

Cooling towers

The only figures available for cooling towers are those collected by the Bureau of the Census. In 1986, the latest year for which these data are available, the Bureau reported 9,579 cooling towers were shipped. This represented a 13.4% decline from the 11,063 cooling towers the Bureau said were shipped in 1985.



REFRIGERATION

Gains in low-temperature cases helped unit shipments of commercial refrigeration equipment show a 3.1% increase in 1988 over the previous year's performance, according to the Commercial Refrigerator Manufacturers Association (CRMA).

The trade association does not report numerical totals for shipments or for the various equipment categories.

Based on the percentages supplied by CRMA, plus data published in prior years by the Air Conditioning and Refrigeration Institute (ARI) and the Bureau of the Census, *The News* estimates that shipments in 1987 totaled 108,800 units. The 3.1% increase in 1988 would bring the new total to 112,200 units.

CRMA reported that shipments of standard-temperature cases in 1988 increased by 1.6% over shipments in the same category a year earlier. These cases represent about 60% of the total, or about 67,300 cases in 1988.

Of the standard-temperature cases, shipments of meat cases last year were down 0.61%; produce cases were down 1.5%; dairy cases were up 7.1%; and island units were down 6.4%, according to CRMA.

The trade association no longer provides figures for walk-in coolers.

Shipments of low-temperature

cases in 1988 increased by 7.9% over shipments in this category in 1987.

For the same period, CRMA reported that low-temperature multideck shipments were up 8.6%; single-decks (coffins) were up 22.6%; and island units were up 1.8%. Of the enclosed (glass door) display cases, shipments of two-door units were up 51.1%; three-door units were up 1.4%; four-door units were up 6%; and five-door units were up 11.3%.

Food sales up

In 1987, the nation's 30,400 supermarkets did \$228.5 billion in sales, up 4.1% from the previous year's total despite the reduction of 200 stores, according to *Progressive Grocer* magazine. To qualify as supermarkets, stores must report annual sales of more than \$2 million.

The 13,625 independent supermarkets (44.8% of the total) reported 1987 sales of \$72 billion (31.5% of total sales). The 16,775 chain supermarkets (55.2% of the total) reported 1987 sales of \$156.5 billion (68.5% of total sales). The top 10 chains account for 31% of all supermarket sales.

In addition to the supermarkets, *Progressive Grocer* reported that 50,000 convenience stores accounted for \$22.4 billion in non-grocery sales in 1987 and 69,600 small grocery stores did \$62.1 bil-

lion in sales. The small store group also includes 200 economy warehouses and 2,900 super warehouse stores.

Remodel emphasis

The construction emphasis among supermarket operators in 1987 has been on remodels. Higher building costs, a diminishing number of good store sites, and increased competition are among the chief reasons. A wave of buy-outs and mergers also has led to store closings as the new owners consolidate operations in local markets.

According to the Food Market-

ing Institute, in 1987 the period between major remodels ranged from three years to 8.5 years. In 1980, it was five to 10 years. Put another way, almost 10% of the nation's 30,400 supermarkets experience major renovations annually in the late 1980's. In the early years of the decade, the figure was 6%.

The average cost of an independent supermarket remodel in 1987 was \$166,100, according to *Progressive Grocer*. In 1977, it was \$63,600. Chains did not release remodel figures but the range is believed to be wide — from \$200,000 to more than \$1 million.

The trend toward larger and larger supermarkets appears to have stalled. Today's average new supermarket is about 60,000 sq ft. Hypermarkets, which offer a large variety of nonfood items, are falling out of favor. The nation's 50 hypermarkets account for 1% of U.S. grocery sales.

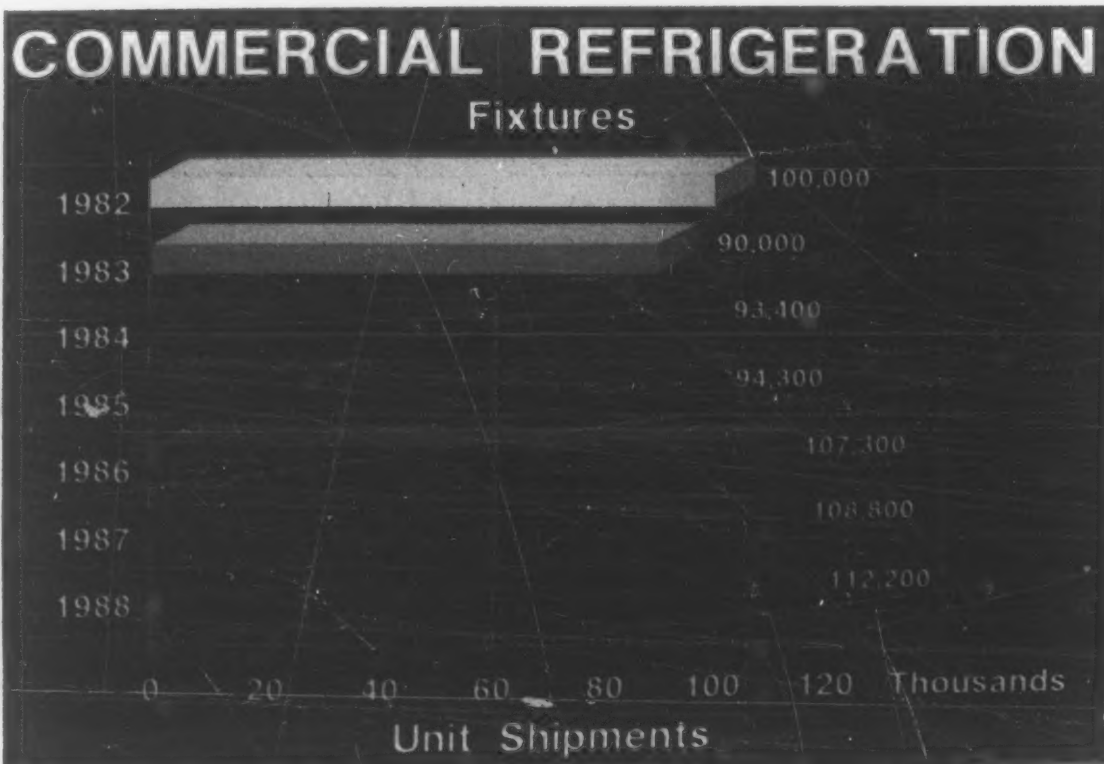
Refrigeration role

Products requiring refrigeration in 1987 accounted for \$94.9 billion, or 41.5% of all supermarket sales. This included \$14.22 billion in frozen foods, or 6.2% of all supermarket sales; \$2.32 billion in ice cream, or 1%; \$38.54 billion in meat and fish, or 16.9%; \$21 billion in produce, or 9.2%; and \$18.7 billion in dairy products, or 8.2%.

According to the 1988 Nielson review, the average lineal footage of shelf space in 1987 was: meat 104 ft (fresh meat 66 ft, poultry 27 ft, fish 11 ft), up 3 ft from 1986; dairy 355 ft, up 16 ft from 1986; and frozen foods 447 ft, up 34 ft from 1986. The per capita consumption of poultry in 1987, at 77.6 lb, surpassed beef, at 75.3 lb, for the first time.

In 1987, the number of supermarkets with delis reached 84%. Average size was 475 sq ft, up from 353 sq ft two years earlier. New preparations suitable for microwave cooking and more mid-range regular and low-calorie din-

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REFRIGERATION

(Continued from Page 14)

ners keep putting additional pressures on frozen food shelf space.

According to *Frozen Food Age*, the frozen food department's direct product profit (DPP) was \$8.06/sq ft/week in 1987 while that for the whole store was \$1.28. Sales of ice cream, with a DPP of \$11.06, grew only 1.5% in 1987, primarily because of a lack of shelf space.

Progressive Grocer said the percent of supermarket owners purchasing meat cases in 1987 was 25% for independents, 15% for chains; deli cases 22% independents, 19% chains; glass-door freezers 21% independents, 16% chains; open-well freezers 10% independents, 8% chains; open multideck freezers 6% for each; and energy conservation devices 11% independents, 17% chains.

Among independents, 84% bought equipment of some kind in 1987. The average equipment purchase was \$68,730. Of refrigerated equipment, there was a continuing trend toward island and "Y"-type cases for meat and dairy departments. Energy costs ranked 12th on a list of supermarket operator concerns and 6th on a list of major problems.

CFC concerns

Because most supermarkets use CFC-12 and CFC-502 (a half-and-half azeotrope of HCFC-22 and CFC-115) refrigerants, the Commercial Refrigerator Manufacturers Association (CRMA) has expressed deep concern over the impact of the CFC production freeze this year and later cutbacks.

It is seeking tax incentives for retailers forced to redesign refrigeration systems, a review of the need to put CFC-115 on the Environmental Protection Agency's (EPA's) restricted list, intensified alternative refrigerant research, EPA coordination with standards-writing agencies, and improved leak detection and refrigerant recycling programs.

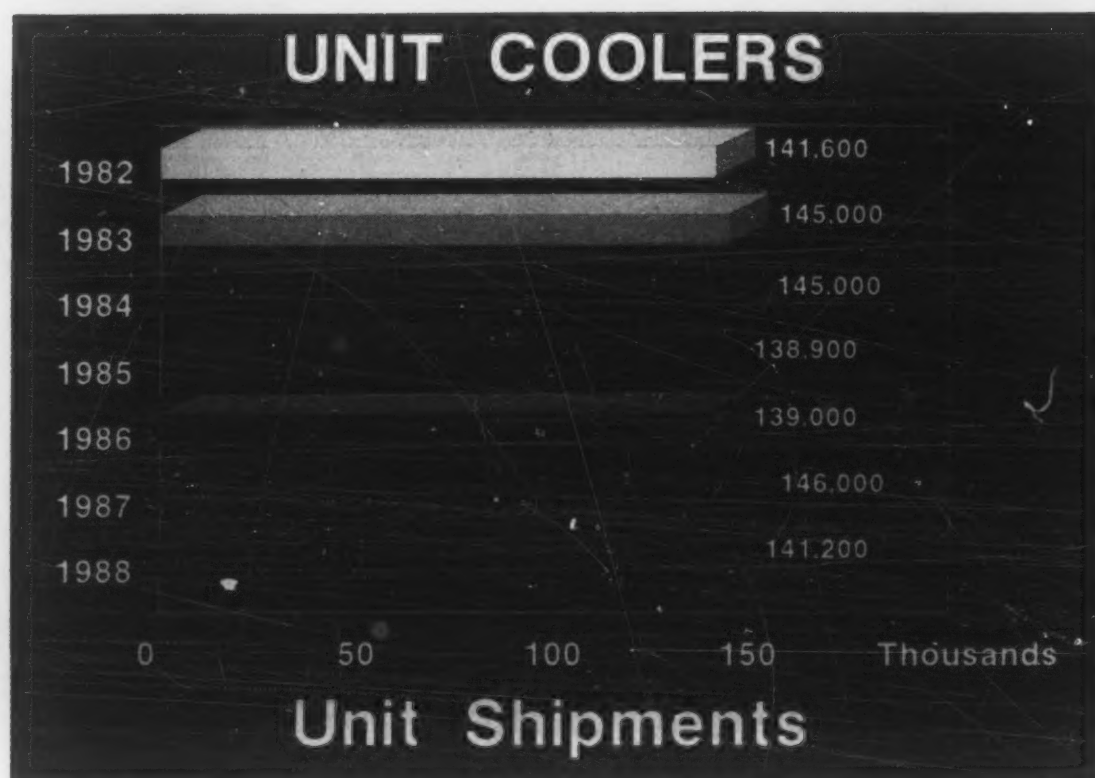
Another major concern is the loss of efficiency if CFC-11 can no longer be used as a blowing agent for foam insulation used in refrigerated cases. They also see a switch from parallel to individual refrigeration systems because of the danger of large refrigerant losses if a leak is experienced in parallel systems.

Although HCFC-22 has been suggested as an alternative to CFC-12 and CFC-502 in medium- and low-temperature supermarket applications, there is concern that the high compression ratios and high compressor discharge temperatures will lead to decomposition of lubricating oils and a substantial reduction in reliability.

A switch to HCFC-22 also would mean compressor and substantial piping changes which, in addition to the initial cost, would also mean a loss in operating efficiencies. Until now, HCFC-22 has almost never been used for low-temperature refrigeration applications below 10°F.

Restaurants

Sales for all U.S. away-from-home eating and drinking places in 1989 could total \$227.3 billion, according to the National Restaurant Association. That would represent a 6.7% increase over the industry's 1988 performance but, after inflation, the increase would be



only 2.2% and a continuation of the lackluster performance of the past two years.

Of the \$157.7 billion in sales for all commercial eating and drinking places, full-service restaurants, at \$74.4 billion (up 6.1%), and fast food restaurants, at \$65.1 billion (up 8.2%), will lead the way. Ice cream parlors, cafeterias, and bars and taverns are not expected to show much real growth.

Among the \$12.8 billion in sales by food contractors, airline caterers — with a 9% (5% real) increase expected this year — lead the way. But educational, commercial office building, and contracted institutional feeding are not far behind. The increase for the whole group is forecast at 8.3%, or 3.6% in real terms.

Among lodging places, the \$11.8 billion hotel restaurant business should show a 7.3% increase but motor hotel and motel restaurants can expect a slight decline in real terms. In-store restaurants are expected to show a 9.5% increase but the \$24.2 billion in institutional food services represents a no-growth pattern.

Technomic, Inc., a Chicago-based research company employed

by the Food Service Manufacturers Association, said 1989 increases will come for airline catering and supermarket delis (5%), convenience stores and recreation feeding (4%), fast foods (2.5%), and in-store restaurants (2.3%).

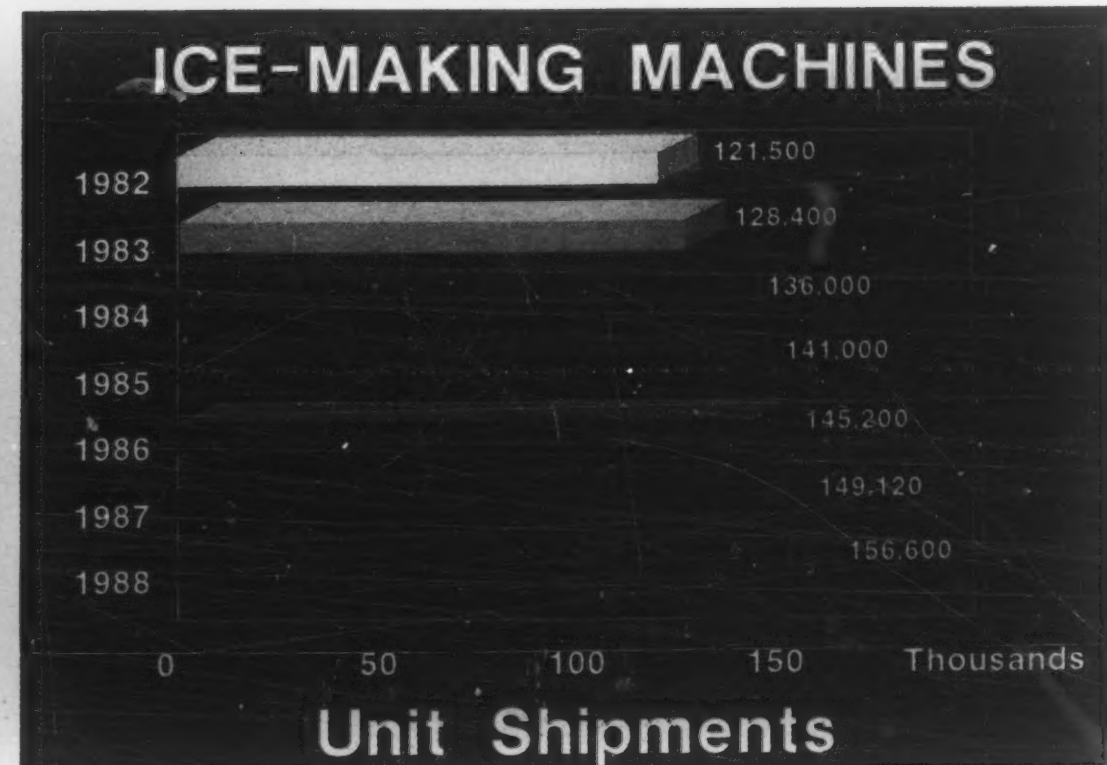
Because of increased competition, the average food expenditure/airline passenger has increased from \$3.94 in 1986 to \$4.21 in 1989. The firm reported that half of all the nation's convenience stores now have facilities to enable cooking on the premises.

Refrigerators

Home refrigerator shipments totaled 7,227,000 units in 1988, an 11.1% increase over the 6,502,600 refrigerators shipped in the previous year, according to the Association of Home Appliance Manufacturers (AHAM).

It would appear that the appliance manufacturers, who forecast a 3.5% drop last year, might be misreading the strength of the replacement market. Again, in November, 1988, AHAM members forecast a 9% decline this year to 6,630,000 units. We feel the decline will be less than 5%.

Shipments of home freezers in



1988 totaled 1,348,700 units, an increase of 14.9% over the 1,174,000 home freezers shipped in the previous year.

The 1988 breakdown shows 726,600, or 54%, were chest-type freezers, up 13% from the 642,700 chest freezers shipped in 1987; and 622,200, or 46%, were upright freezers, an increase of 17.1% over the year-previous total of 531,300 upright freezers.

Again, manufacturers are looking for an 8.9% drop in home freezer shipments in 1989 to 1,236,000 units. With the benefit of nearly four months, we don't think the decline will top 4%.

Unit coolers

Shipments of unit coolers, at 141,200 units in 1988, declined by 3.3% from the previous year's total of 146,000 units.

It should be noted that the Bureau of the Census reported that 196,150 unit coolers were shipped in 1987, the latest year for which these data are available. This represents a 5.3% increase over the 1986 total of 186,301 units.

The industry figures do not include exports or the production of several significant manufacturers.

Ice-makers

Returning to the format of past Statistical Panoramas, shipments of ice-making equipment in 1988 totaled 156,600 units, an increase of 5% over the 149,120 ice makers shipped in the previous year. *The News* believes 82% were cubers and 18% were flakers.

For two years we added ice maker-dispenser combinations, a move that added 90,880 units to the 1987 total. We are discontinuing that reporting this year for two reasons. We are not confident all types of dispensers are included and, by reporting partial figures, we would only succeed in confusing readers.

The Bureau of the Census reported that 208,040 ice makers were shipped in 1987, the latest year for which these data are available. This represents a 2.5% increase over the 202,936 ice makers the Bureau said were shipped in the previous year.

The discrepancy between industry and government figures has existed for many years and has yet to be resolved. Both sets include domestic and export shipments.

HEATING

Replacements, upgrading keep gas furnaces even

Even though single-family housing starts sagged a bit last year, replacements and technology improvements that have allowed homeowners to upgrade efficiencies have helped keep gas furnace shipments at a high level.

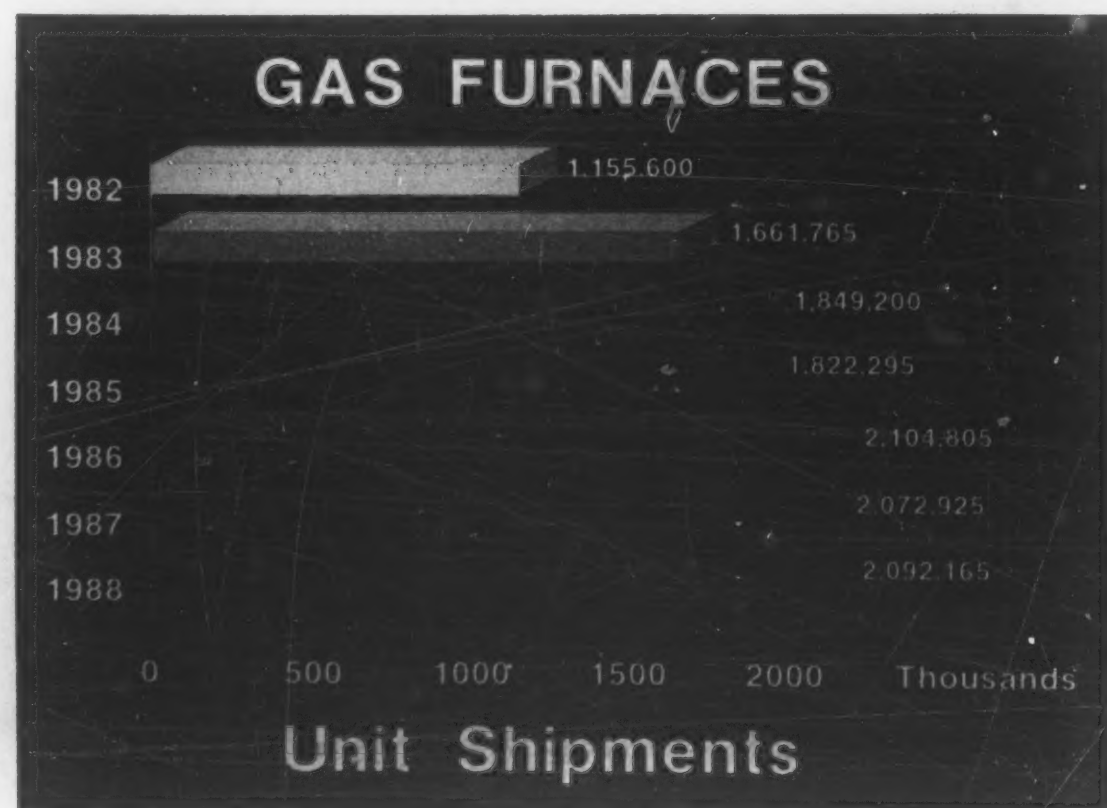
Shipments of gas furnaces last year totaled 2,092,165 units, up 0.9% from the 1987 total of 2,072,925 units, according to the Gas Appliance Manufacturers Association (GAMA).

The 1988 mark was within a whisker of the 1986 record and the third year in a row with shipment totals above 2 million units. The strength of the replacement and upgrade markets is emphasized by a simultaneous drop of nearly 6% in new single-family home construction and relatively mild

weather in its most important market areas.

It is significant, too, that more than one-third of the gas furnaces shipped last year had efficiencies above the 78% AFUE (annual fuel utilization efficiency) minimum that will become mandatory in 1992. And, as is provided in more detail in the *Comfort in construction* section of this report, contractors and homeowners appear to be gaining more confidence in condensing furnaces with AFUE's of 86% or more.

In November, 1988, GAMA's members forecast that gas furnace shipments will decline by 3.5% this year. We can't agree. Even though single-family housing starts could drop by nearly 10% this year, it would cost gas furnace



HEATING

installers and manufacturers less than 70,000 units. We predict that gas furnace shipments in 1989 will hold even at 2.1 million units.

For the record, the Bureau of the Census reported that 1,762,892 gas furnaces were shipped in 1987, the latest year for which these data are available. This represents a 3.7% increase over the 1986 total of 1,700,626 units. The Census Bureau also noted that 1,635 gas-fired gravity furnaces were shipped in 1987, down 13.8% from the 1,897 gravity warm-air furnaces reported for the previous year.

Here and elsewhere in this issue we will report Bureau of the Census figures where they are available, even though they often vary considerably from industry figures. We favor the industry figures because they are more up-to-date and, in our opinion, more accurate.

Oil furnace market softens

The strength of the replacement market overcame declines in prime market home construction and stable oil prices, holding oil furnace shipments on a high plateau that has persisted for the past three years.

Shipments of oil furnaces last year totaled 203,785 units, down only 1.3% from the 206,445 oil furnaces shipped in 1987, according to GAMA. Last year's performance was only about half that of the 1970 peak year (411,600 units), but also a far cry from the 63,400 units shipped a decade later when oil prices were going through the roof.

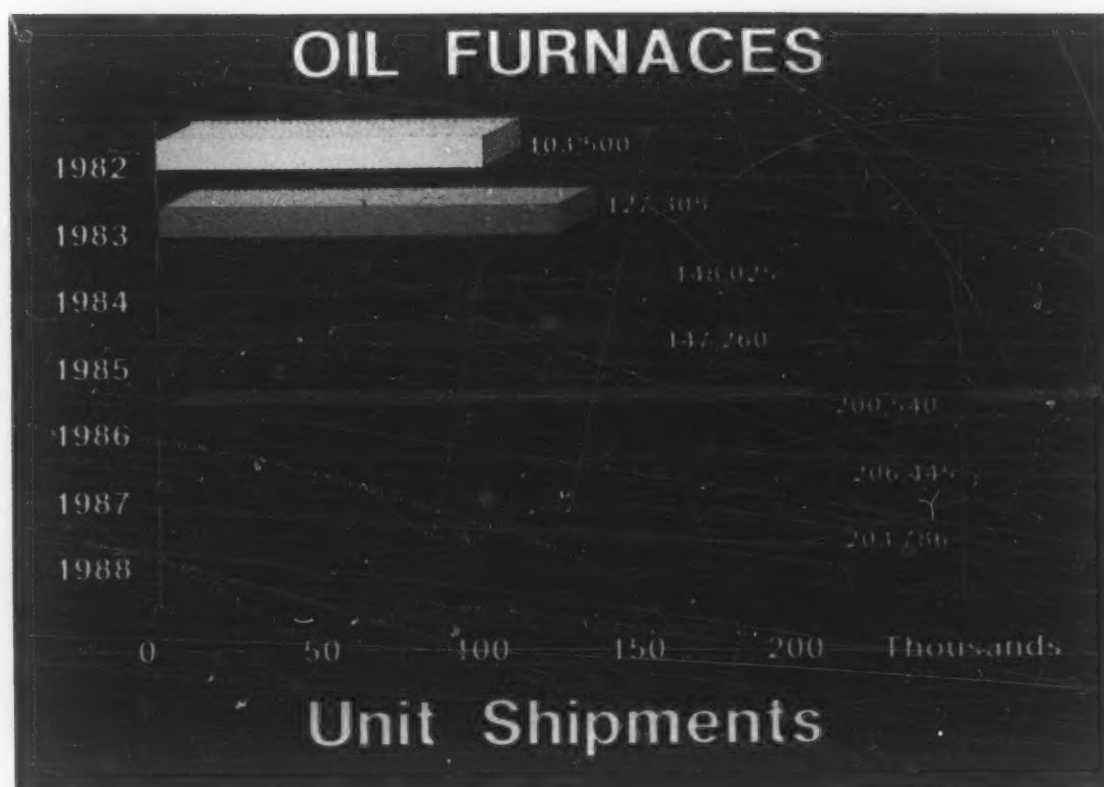
Replacements have been a major factor in the oil furnace market for many years. This market segment was helped by a spurt in home construction in the Northeast, oil-fired equipment's prime market, that peaked in 1986. That housing market declined by 8.4% in 1987, by 12.5% last year, and could drop by another 10% in 1989 as home price and land availability problems persist.

It should be noted, however, that 80% of the nation's oil-fired home heating systems are located in the Northeast and that almost 90% of these systems were installed prior to 1964, when oil prices were less than 20 cents/gal. In the early 1980's, when oil prices skyrocketed to \$1.30/gal, there was a mad scramble to convert to other fuels. With the moderation in oil prices, oil furnaces and boilers have regained much of the lost market share.

Oil furnaces should have no difficulty meeting the coming federal mandatory minimums. In 1988, more than two-thirds of the oil furnaces shipped had AFUE's of 80% or more. Only 1.8% of shipments had efficiencies below 75%.

GAMA's members feel oil furnace shipments in 1989 will decline by 3.5%. We agree. Although the replacement and upgrading of existing furnaces will continue to increase, we don't think it will be enough to offset all of the losses in new home construction. Shipments in 1989 should total a still-respectable 196,800 units.

As an aside, the Census Bureau reported that 157,758 oil-fired furnaces were shipped in 1987, the latest year for which these data



are available. This represents an 8.3% decline from the 172,038 units reported shipped in the previous year.

Electric furnace slide steepens

Regionality and the electric furnace's close association with new home construction — particularly multifamily units — contributed to a sharp decline in 1988 shipments.

Last year's total, at 293,095 units, represented a 21.9% decline from the 1987 total of 375,055 electric furnace shipments, according to GAMA.

The primary role of electric furnaces has been to serve as a backup heat source for air-to-air

heat pumps and as a sole heat source for homes in relatively mild climates. Unlike its gas- and oil-fired cousins, electric warm air furnaces have only a small replacement market.

Although new home construction is holding up in the South Atlantic region, it is at least a year from a turnaround in other southern markets. These factors are compounded by the sharp drop in multifamily starts, particularly in the South.

Looking ahead, GAMA's members expect only a 2.2% decline in electric furnace shipments this year. We think the drop will be at least 10% — to 263,800 units — and maybe a bit more.

The Bureau of the Census
(Next Page, Please)

EXTRA

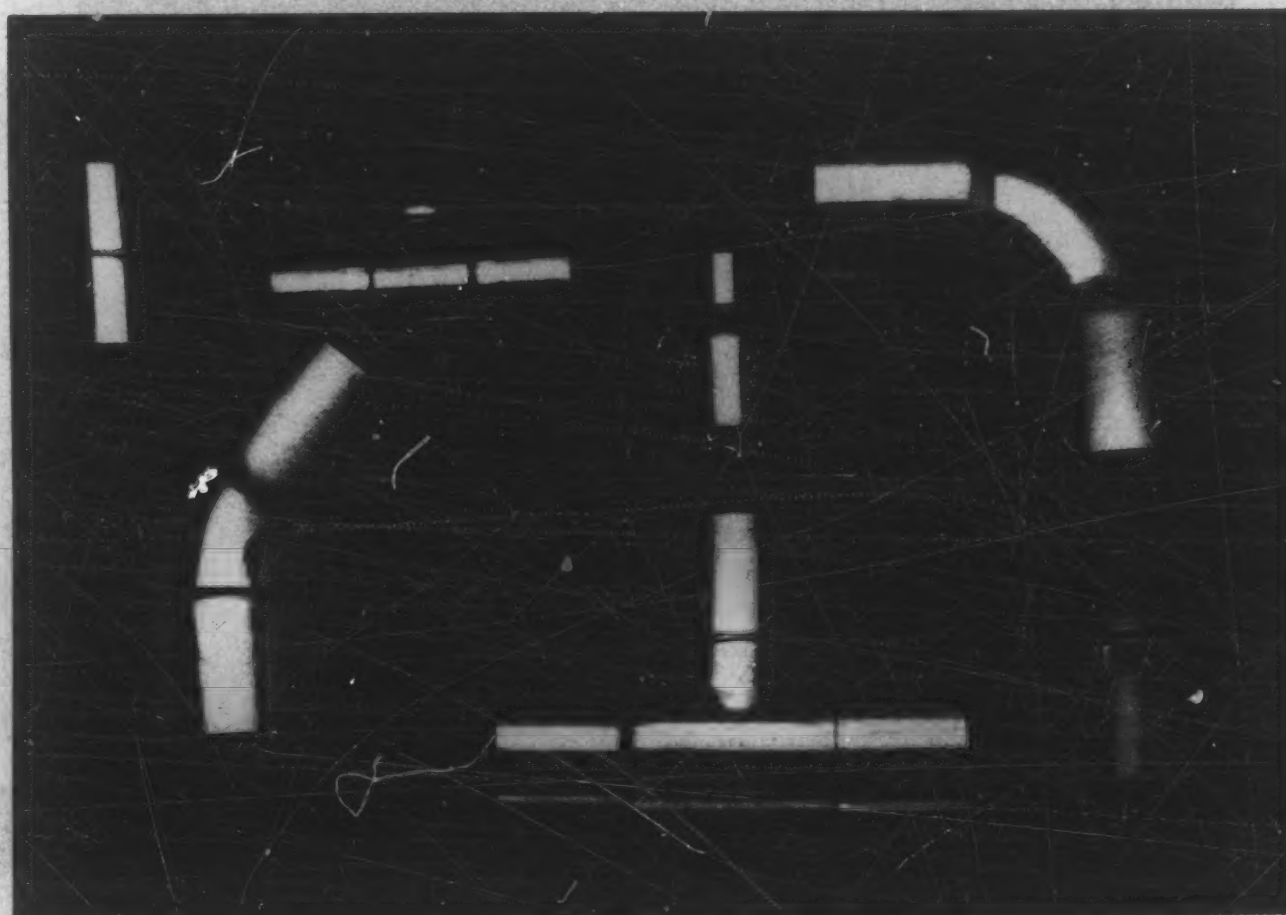
GOOD NEWS

...for Refrigeration/Air Conditioning
Wholesalers and their Customers

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HEATING

(Continued from Preceding Page)

figures provide little insight into electric furnace shipments because they are combined with electric duct furnaces. For the record, the Bureau reported shipments of both categories totaled 607,370 units in 1987 (the latest year for which these data are available), down 0.5% from the 1986 total of 610,419 units.

All furnaces

Total gas, oil, and electric furnace shipments in 1988 amounted to 2,589,045 units, down 2.5% from the 1987 total of 2,654,425 units. It should be remembered that the 1986 total of 2,687,935 units eclipsed the record set in 1972 when housing starts were in their heyday.

The difference between then and now, of course, is the recent strength of the replacement and efficiency upgrade markets. However, the weakness of electric furnaces and the small decline in oil-fired units should result in a decline of 1.1% to a near-record total of 2,560,600 units this year.

Boiler market keeps expanding

A modest increase in new home construction penetration, coupled with strong replacement and efficiency upgrade markets, have helped residential boiler shipments maintain a seven-year upward spiral.

Unit shipments of oil- and gas-fired boilers in 1988, at 367,440 units, represented a 3% increase over the 356,466 cast iron and steel boilers shipped a year earlier, according to The Hydronics Institute (HI).

The 7% increase in 1987 and the 3% rise last year came in the face of 8.4% and 12.5% declines, respectively, in new home starts in the Northeast, the bastion of hydronics. High home prices and a scarcity of land are likely to force a further decline in Northeast new home construction this year, but this development is not necessarily bad for hydronics.

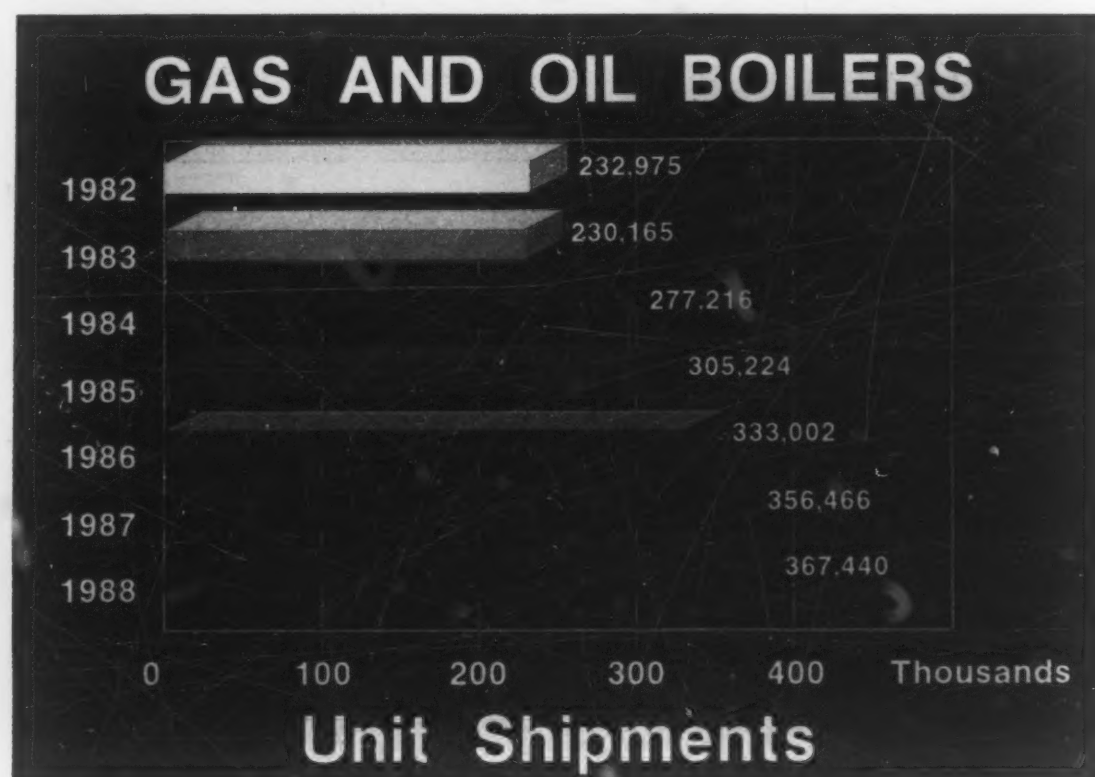
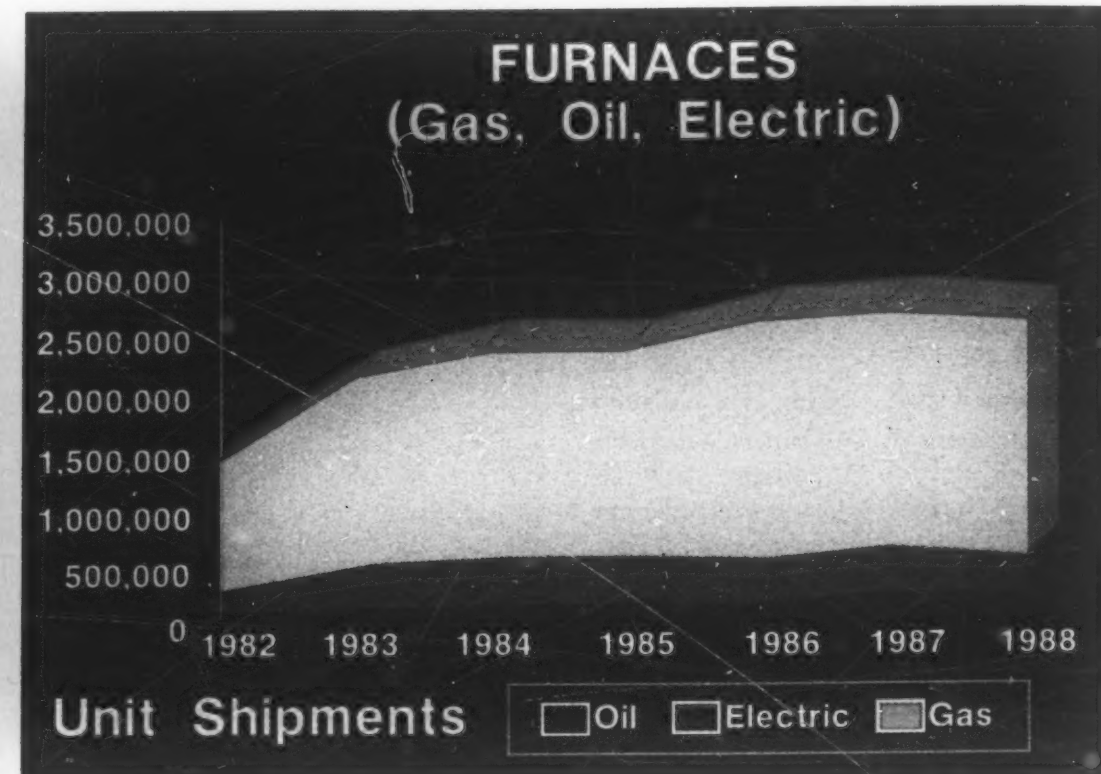
High home prices have forced many potential home buyers to seek less-expensive existing homes, which they upgrade with more efficient boilers, or to upgrade their present homes. This factor, coupled with increased industry promotion, should maintain boiler shipments at a high level.

Shipments of cast iron boilers, at 329,639 units in 1988, increased by 4.7% over the year-previous total of 314,758 units. Shipments of steel boilers, however, were down 9.4% from 41,708 units in 1987 to 37,801 units last year.

Even though gas-fired boilers continue to dominate the market, it wasn't always so. Gas curtailments in the 1970's restricted the sale of gas-fired boilers.

The sudden availability of natural gas at the turn of the decade and a rapid oil price escalation led to a surge of demand for gas units. It wasn't until the mid-1980's that the relationship between oil- and gas-fired units returned close to historical ratios.

The gas share of the cast iron boiler market — which peaked at



1988 steel boiler shipments

Gross output, MBh	Oil-fired	Gas-fired	Bare	Total
Up to 100	7,189	260	669	8,118
101 to 125	12,897	169	1,381	14,447
126 to 150	7,608	53	820	8,481
151 to 175	3,479	39	604	4,122
176 to 200	768	20	69	857
201 to 300	908	31	58	996
301 to 500	329	37	10	376
501 to 750	127	60	12	199
751 to 1,000	49	17	12	78
1,001 to 1,400	44	12	4	60
1,401 to 2,350	34	25	6	65
2,351 to 3,350	2	0	0	2
Total	33,433	723	3,645	37,801

85% in 1980 from a low of 50% only three years earlier — was 58.5% in 1988, down slightly from a 59.8% share a year earlier. Total shipments of gas-fired cast iron boilers, however, increased by 2.4% from 188,284 units in 1987 to 192,754 units last year.

Oil's share of the cast iron boiler market — which peaked at 49.5% in 1977 and dropped to only 15% three years later — was 41.5% in 1988, up a bit from 40.2% a year earlier. Total shipments of oil-fired cast iron boilers amounted to 136,885 units, an increase of 8.2% over the prior-year total of 126,516 units.

The share of cast iron hot water boilers, at 83% last year, was up from 81.6% in 1987. Shipments of hot water units, at 273,751 units in 1988, were up 6.7% from the 1987 total of 256,680 units. Conversely, steam's share slipped from 18.4% in 1987 to 17% a year later and shipments declined 3.8%.

In the case of steel boilers, oil continues to dominate but gas is gaining. The 33,433 oil-fired steel boilers shipped last year represented a slight gain in market share (from 86.2% in 1987 to 88.4% last year), but a 7% drop in shipments from the 1987 total of 35,942 units. Gas-fired units gained in market share from 1.7% in 1987 to 1.9% last year, and the 723 units shipped in 1988 amounted to a 4.3% increase over the 693 units shipped in 1987.

The 3,645 bare (without burners) steel boilers shipped in 1988 accounted for the remaining 9.6% share, down from 12.2% a year earlier. Shipments of bare units also were down. The 3,645 units

shipped last year represented a 28.2% drop from the 5,073 units shipped in 1987.

Radiation shipments in 1988, according to HI, were:

Convectors — 1,813,427 sq ft EDR (equivalent direct radiation), up 2% from the 1,776,982 total for 1987.

Baseboard — 16,002,674 lineal feet, down 2.1% from the 1987 total of 16,352,889 lineal feet.

Commercial finned tube — 7,583,456 sq ft EDR, up 11.6% from the 1987 total of 6,796,633 sq ft EDR.

Finned tube — 1,435,982 lineal feet, up 7.1% from the 1,340,496 lineal feet shipped in 1987.

Looking ahead, the hydronics industry cannot expect that increased market penetration will make up for the decline of new home starts in its prime markets. But the demonstrated strength of replacements and efficiency upgrades in the face of new construction declines over the past two years gives us the confidence to project that residential boiler shipments will hold even in 1989.

Commercial boilers

The commercial boiler market for 1989 is expected to total 22.3 million pph (pounds of steam per hour), a decline of 8.2% from the 1988 order rate of 24.3 million pph, according to the American Boiler Manufacturers Association (ABMA).

The manufacturer trade association expects burner shipments in 1989 to total 17,800 units, about the same as the 17,825 units shipped last year. Projected increases in spreader- and overfeed-type stokers is expected to push

1989 stoker shipments to 36 units, from 27 units in 1988.

The 1989 forecast for industrial boilers, at 27.9 million pph, represents a 3.8% decline from last year's 29 million pph level. The cogeneration market, which in 1988 accounted for 1,335 megawatts (MW), is expected to decline by 27.4% this year to 969 MW.

ABMA forecast a combined total of 3.1 million pph for both mass-burn and refuse-derived-fuel municipal solid-waste boilers this year, down 8.8% from the 3.4 million pph total for 1988.

Pressurized and atmospheric watertube fluid-bed combustion unit shipments are expected to total 9.1 million pph in 1989, an increase of 127.5% over last year's total of 4 million pph. Atmospheric units are the major contributors to the increase.

For the record, combined domestic and export orders for utility boilers in 1989 are expected to total 4,275 MW, an increase of 81.3% from the 1988 total of 2,358 MW. Exports are the major contributors for both years.

More gas products

Shipments of gas-fired unit heaters, at 169,605 units in 1988, increased by 3.4% over the previous year's total of 164,080 units, according to GAMA.

Of the total, shipments of propeller-type unit heaters in 1988 totaled 159,129 units, up 3.9% from the previous year's total of 153,085 units. Blower-type unit heater shipments, at 10,476 units in 1988, were down 4.4% from the 1987 total of 10,995 units.

GAMA's members expect unit

heater shipments in 1989 will increase by 1.6%. Given the increase in industrial construction expected this year, that forecast could be a bit conservative.

It should be noted that the Bureau of the Census reported that, in 1987 (the latest year for which these data are available), 412,261 gas-fired unit heaters were shipped, down 7.2% from the 444,254 unit heaters shipped in 1986. The government figures obviously include the outputs of manufacturers who do not participate in the industry program.

Gas-fired duct furnaces declined by 3.4% in 1988 to 18,002 units, according to GAMA. The 1987 total was 18,629 units. The manufacturers expect a 3.2% improvement this year.

Gas-fired residential wall furnace shipments in 1988 totaled 173,200 units, up 4% from the 166,540 wall furnaces shipped in 1987, according to GAMA. Its members expect a 2% increase in 1989 shipments. The GAMA category does not include wall furnaces installed in recreational vehicles.

The total does include vented wall furnaces, which increased by 2% from 105,540 units in 1987 to 107,870 units last year, and direct-vent wall furnaces, which increased by 7.5% from 60,800 units in 1987 to 65,330 units in 1988.

The Census Bureau reported 332,329 residential wall furnaces were shipped in 1987, up 5.5% from the 305,641 units reported shipped in 1986.

Shipments of recreational vehicle heating systems in 1988 totaled 235,518 units, an increase of

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HEATING

(Continued from Page 18)

0.3% over the 234,771 units shipped the previous year. The total includes wall furnaces installed in recreational vehicles.

Shipments of **gas-fired floor furnaces** totaled 20,300 units in 1988, up 3% from the 19,704 units shipped in the previous year, according to GAMA.

The Census Bureau reported that 19,808 gas-fired floor furnaces were shipped in 1987, the latest year for which these data are available. That was an 18.6% decline from the 1986 total of 24,330 units.

GAMA reported that a total of 293,586 **gas-fired room heaters** were shipped in 1988, an increase of 9.7% over the 267,669 units shipped the previous year. Of these, 91,426 were vented room heaters in 1988, up 1% from the 90,564 units shipped in 1987, and 202,161 were unvented room heaters in 1988, up 14.1% from the 1987 total of 177,105 units.

More about oil

Oil burner installations in 1988 totaled 491,000 units, down 15% from the previous year's total of 578,000 units, according to *Fuel Oil/Oil Heat* magazine.

Of these, 53,000 were installed in new single-family homes, down 1.8% from the 54,000 oil-fired systems installed in new homes in 1987. New home installations totaled 85,000 in 1979.

The new home market in the Northeast, the prime market for oil-fired systems, peaked in 1986. The decline, even though modest, has persisted for the past two years and is expected to continue through 1989.

There were 218,000 **replacement oil burners** shipped in 1988, a decline of 8% from the 237,000 replacement burners shipped in the previous year. The magazine estimates that nearly all of these burners were retention-head or other high-efficiency types.

Fuel Oil/Oil Heat estimates that 180,000 oil-fired furnaces were shipped in 1988, the same number as in the previous two years, and that 167,000 oil-fired boilers were shipped in 1988, up 3.7% from the 161,000 units shipped in the previous year.

Conversions to oil from other fuels in 1988 were estimated at 33,000, down 15.4% from 1987. Only 9,000 conversions were made in 1984. Most of the conversions were from electricity although, in areas where natural or LP gas is expensive, some have converted to oil. Conversions from oil to natural gas, which reached 300,000 in 1980, were not significant last year.

The Bureau of the Census reported that 18,519 **separate commercial and industrial oil burner units** were shipped in 1987, the latest year for which these data are available. This represents a 2.9% decline from the 19,064 units shipped the previous year. Another 5,601 commercial-industrial burners were shipped with boilers in 1987, up 20.8% from the 4,636 units shipped the previous year.

The Census Bureau reported that shipments of **oil-fired floor and wall furnaces** in 1987 totaled 5,346 units, up 9.8% from the 4,868-unit total for 1986.

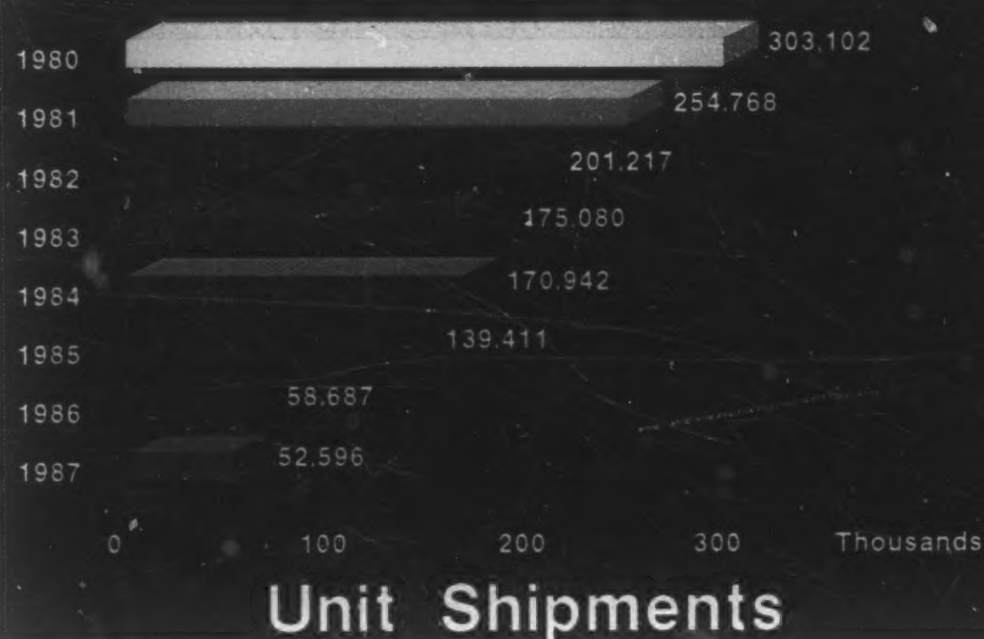
1988 cast iron boiler shipments by thermal capacity

Gross output, Btu/h	Steam	Water	Total
Less than 50,000	826	8,834	9,957
50,000 to 74,999	1,302	25,605	26,907
75,000 to 99,999	7,821	54,312	62,133
100,000 to 124,999	15,971	84,007	99,978
125,000 to 149,999	5,342	21,727	27,069
150,000 to 199,999	10,641	53,099	63,740
200,000 to 249,999	5,315	13,651	18,966
250,000 to 449,999	3,965	7,616	11,581
450,000 to 949,999	2,190	2,682	4,872
950,000 to 1,549,999	1,108	998	2,106
1,550,000 and over	1,310	1,220	2,530
Total	55,888	273,751	329,639

1988 cast iron boiler shipments by fuel

Gross output, Btu/h	Gas-fired	Oil-fired	Total
Less than 50,000	8,736	21	8,757
50,000 to 74,999	26,839	68	26,907
75,000 to 99,999	53,494	8,639	62,133
100,000 to 124,999	47,366	52,612	99,978
125,000 to 149,999	20,238	6,831	27,069
150,000 to 199,999	14,561	49,179	63,740
200,000 to 249,999	10,521	8,445	18,966
250,000 to 449,999	6,701	4,880	11,581
450,000 to 949,999	2,214	2,658	4,872
950,000 to 1,549,999	717	1,395	2,112
1,550,000 and over	367	2,157	2,524
Total	192,754	136,885	329,639

SOLAR COLLECTORS



The Bureau reported that, in 1987, a total of 554,708 residential replacement oil burners were shipped, up 7.6% from the 515,611 replacements shipped in the previous year. It reported that 49,338 residential oil burners were shipped with furnaces in 1987, down 1% from 1986, and that 49,735 residential oil burners were shipped with boilers in 1987, up 4.5% from 1986.

It's significant that, in its notes, the Bureau stated that 95% of the boilers and 100% of the furnaces were equipped with flame retention-head or other high-efficiency burners.

Other heating equipment

Additional perspective on the total comfort space heating market is provided by the Bureau of the Census. The Bureau reported that for 1987, the latest year for which these data are available, 903,942 **domestic heating stoves** were shipped, down 16.3% from the 1,080,260 heating stoves shipped in the previous year.

Of these:

- 198,443 were **gas heating stoves** in 1987, down 21% from the 1986 total of 163,877 units. This category includes radiant types as well as vented and unvented circulating types.

- 262,484 used **other fuels** in 1987, down 18.9% from the 1986 total of 323,774 units. The other fuels include kerosene, gasoline, fuel oil, and coal.

- The total for **wood stoves** in 1987, at 106,786 units, was down 13.3% from the 123,110 stoves shipped in 1986. Of these, 38,654 were circulating types, down 16.5% from 46,317 units; 43,453 were radiant types, up 5.3% from 41,264 units; and 24,679 were other types, down 30.5% from a 1986 total of 35,529 units.

Of the **fireplaces**:

- 24,333 were free-standing fireplaces in 1987, down 53.3% from the 52,145 units shipped in 1986.

- 256,944 were zero-clearance fireplaces in 1987, down 25.7% from the 1986 total of 345,942 units.

- 54,952 were fireplace inserts in 1987, down 23% from the previous year's total of 71,412 units.

Of the **other electrical heating equipment**:

- 30,653 were nonresidential infrared heaters in 1987, down 17% from the 1986 total of 36,965 units.

- 2,138,632 were electric baseboard heating units (excluding glass panels) in 1987, down 7.4% from the 1986 total of 2,308,986 units.

- 1,525,627 were fixed electric space heaters other than baseboard in 1987, down 0.2% from the 1986 total of 1,528,777 units.

- 280,808 were electric unit heaters in 1987, down 12.3% from the 1986 total of 320,287 units.

Pool heating dominates solar

From its peak in 1980, when 303,102 solar collectors of all types were shipped, the solar industry has been in decline. The drop was dramatic after 1985 with the expiration of the 40% residential and 15% business energy tax credits.

According to the Bureau of the Census, shipments of solar collectors in 1987 (the latest year for which figures are available) totaled 52,596 units. This represents a 10.4% decrease from the 58,687 units shipped in the previous year — and a 62.3% drop from the 139,411 units shipped as late as 1985.

Retroactive reinstatement of the business energy tax credit — at

15% for 1986 and 12% for 1987 and 1988 — had little effect because of the small market share for commercial systems (305,000 sq ft in 1987 or 7.4% of the total) and falling oil prices.

Solar collector shipments, which averaged more than 18 million sq ft between 1980 and 1985, fell to less than 5 million sq ft in 1986 and 1987.

The Bureau of the Census report shows only that low-temperature collector shipments, at 47,540 units in 1987, were down 3.5% from the 49,243-unit total for the previous year. Medium-temperature collector shipments, both air and liquid types, totaled 5,056 units in 1987, down 46.5% from the 1986 total of 9,444 units.

A profile of the solar collector manufacturing industry published by the Energy Information Administration (EIA) provides more detailed information.

Although the number of manufacturers declined from 97 in 1986 to 58 a year later, it shows the average shipment per medium-temperature collector manufacturer increased from 13,000 sq ft to 19,000 sq ft. The average shipment per low-temperature collector manufacturer increased from 170,000 sq ft to 263,000 sq ft in the same period.

EIA reports that, in 1987, a total of 4,114,000 sq ft of solar collectors were shipped, down 15.4% from the 4,862,000 sq ft shipped in 1986. In 1981, 20,133,000 sq ft of solar collectors were shipped. The top five companies shipped 78.2% of the industry total in 1987, up from 67.3% a year earlier.

By far the largest application category in 1987 was swimming pool heating, which accounted for 3.1 million sq ft of collectors or 75.6% of the total. Of the pool heating segment, 99.1% was accomplished with low-temperature collectors and only 0.9% was handled by medium-temperature flat plate collectors.

Domestic hot water heating, with 964,444 sq ft in 1987, was the second-largest application grouping. It accounted for 23.4% of the total. Of this group: 71,570 sq ft, or 7.4%, used low-temperature collectors; 282,020 sq ft, or 29.2%, used medium-temperature thermosiphon (circulation without a pump) systems; 545,389 sq ft, or 56.6%, used pumps and medium-temperature flat plate collectors; 62,150 sq ft, or 6.4%, used medium-temperature integral storage systems; and 3,048 sq ft,

or 0.3%, were medium-temperature evacuated tube systems.

Space heating-only systems accounted for 22,512 sq ft of collectors in 1987, or 0.5% of the industry total. Of these, low- and medium-temperature accounted for 19,532 sq ft of collectors, or 86.8%. Medium-temperature air systems accounted for 2,980 sq ft, or 13.2%.

Combined space and domestic hot water heating systems accounted for 8,488 sq ft of collectors in 1987, or 0.2% of the industry's total shipments. Of these, a total of 6,888 sq ft, or 81.1%, were pumped medium-temperature liquid flat plate units. Although some manufacturers reported shipments of both air and liquid (flat plate, integral storage) collectors for space cooling, the figures were not revealed in order to protect individual company data.

Of the total 4,113,873 sq ft of collectors shipped in 1987, low-temperature liquid and air units accounted for 3,157,000 sq ft, or 76.7%. Of the medium-temperature collectors, 3,480 sq ft were air collectors, 282,020 sq ft were thermosiphon units; 597,549 sq ft were pumped flat plate units, 62,650 sq ft were integral storage units, and 6,938 sq ft were evacuated tube units. Another 3,733 sq ft was used in concentrating collectors and 500 sq ft was used for other systems.

Looked at another way, the 3,775,407 sq ft used in residential systems represented 91.8% of the solar market in 1987. Commercial systems, at 305,115 sq ft, represented 7.4%. Industrial systems, at 11,385 sq ft, represented 0.3% and all other uses accounted for the remaining 0.5%.

It's interesting to note that, although medium-temperature collectors represented only 23% of the total square footage in 1987, they accounted for 65% of the shipment value.

Imports in 1987 totaled 691,000 sq ft of collector, an increase of 46% from the 473,000 sq ft imported the previous year. Exports in 1987 totaled 187,000 sq ft, down 18.8% from 224,000 sq ft a year earlier.

Photovoltaic module manufacturing activity, at 6,856 kW, increased by 8.3% over the 6,333 kW total for the previous year. The value of 1987 shipments was \$45 million, or an average of \$6.56/watt. In 1986, the average factory price of photovoltaic modules was \$6.01/watt.

Use the Reader Action Card in this issue

RELATED PRODUCTS

Humidifiers

The continuing strength of single-family new home starts in prime markets has helped power humidifier shipments climb back to the level enjoyed through much of the 1970's. Existing home sales and more merchandising by contractors have also been major factors.

We believe power humidifier shipments in 1988 totaled 530,400 units, an increase of 10.5% over the total of 480,000 power humidifiers shipped in 1987.

In the face of rising interest rates and a flat replacement market, however, shipments will fare well in 1989 if they can hold at the 500,000 mark. That would be nearly a 6% decline.

Industry executives report that, in the past, 90% of power humidifiers were installed in existing homes and only 10% went into new homes. They often were installed soon after the purchase of a new or existing home by people who, for reasons of health or comfort, felt they wanted the benefits of humidification.

In recent years, however, a growing number of merchandising contractors are quoting on power humidifiers along with furnace or air conditioning replacements. This factor, coupled with the trend toward larger custom homes, has helped humidifiers maintain an upward shipment spiral at a time when new and existing home sales are stagnating.

The principal markets for power humidifiers continue to be the Midwest and the Northeast. According to the Energy Information Administration's 1984 housing characteristics study, 28.5% of homes in the Midwest and 15.2% of those in the Northeast are equipped with power humidifiers.

A fear that the power humidifier market would be limited by the growing number of tightly insulated homes has not materialized. Few super-insulated homes that require ventilators or dehumidifiers to reduce the humidity produced by household activities are being built. The remaining 100 million homes provide solid market potential.

For the record, the Bureau of the Census reported that 454,208 central heating system humidifiers were shipped in 1987, the latest year for which these data are available. That represented a 10.6% increase over the 410,762 humidifiers the Bureau said were shipped in 1986.

Fans

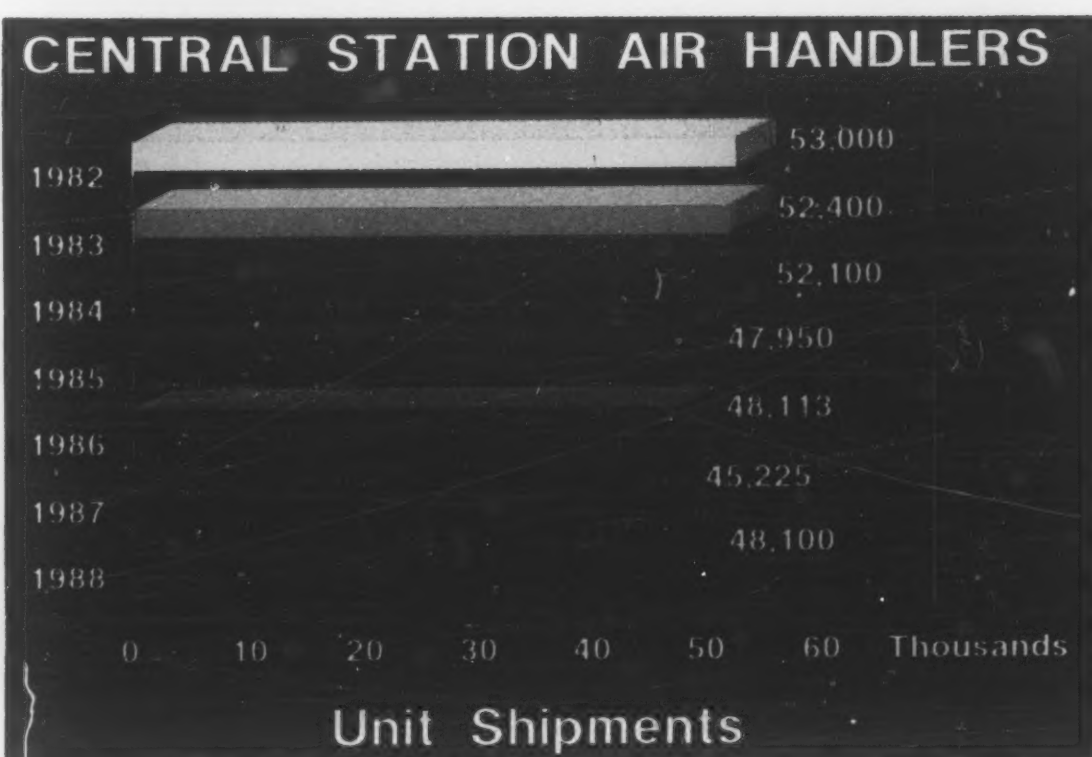
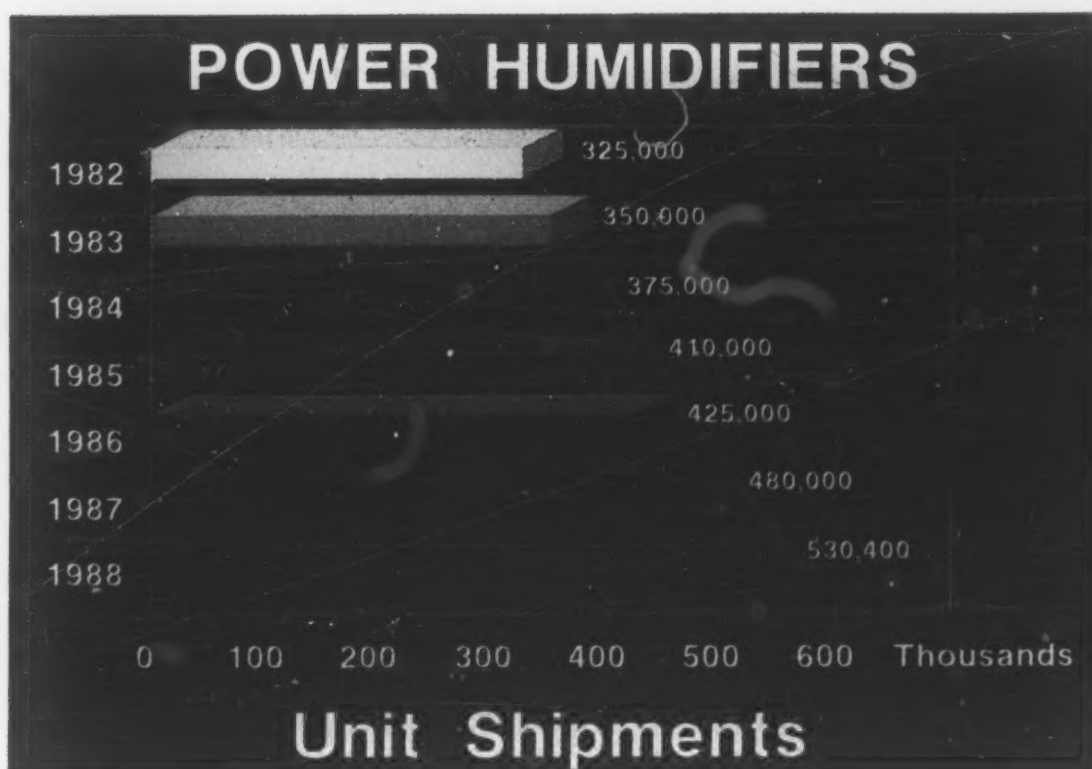
Again in 1988, all four product categories reported by the Air Movement and Control Association (AMCA) demonstrated substantial increases.

Shipments of centrifugal fans in 1988 totaled \$173,278,891, an increase of 26% from the revised \$138,111,900 total for the previous year.

Industrial axial and propeller fan shipments in 1988, at \$75,594,148, were 9% above the revised total of \$69,214,128 for the previous year.

The total value of power roof ventilator shipments last year was a record \$100,409,797, an increase of 16% over the previous record of \$86,240,441 set in 1987.

In the Air Control Division, shipments of louvers, dampers,



and shutters last year totaled \$90,303,953, an increase of 52% over the 1987 total of \$59,367,330.

The total for the four product categories in 1988 was \$439,586,789, an increase of 25% over the previous year's total of \$352,933,799. The totals reflect North American shipments only.

The total value of shipments by AMCA's 188 members in 22 countries for all air-moving and control products included in the trade association's scope last year was estimated at \$605,934,916.

The North American shipment figures do not include the value of shipments made to the power generation market, which were shifted to another category not made public.

Central station air handlers

Shipments of central station air handlers last year totaled 48,100 units, an increase of 6.3% over the 45,225 air handlers shipped in 1987.

For the record, the Bureau of the Census reported that 61,363 central station air handlers were shipped in 1987, the latest year for which these data are available. That represented a 3.6% increase over the 59,206 units shipped in the previous year.

Of those central station air handlers the Bureau said were shipped in 1987, draw-through units constituted 79%; blow-through units made up 12%; and heating and ventilating types made up the remaining 9%.

Electronic air cleaners

Helped by strong heating and cooling replacement sales and a growing number of merchandising contractors, electronic air cleaner (eac) shipments increased in 1988, even though new home starts

sagged a bit.

According to our estimates, shipments of electronic air cleaners in 1988 totaled 193,500 units, an increase of 5.8% over the previous year's total of 182,900 units.

Eac's have a special compatibility with heat pumps because of their ability to keep the indoor coil clean in winter when it has no condensate to help remove airborne dust. They are also helpful in removing the short-lived radon daughters that characteristically attach themselves to airborne particles. Eac's cannot, however, remove radon gas.

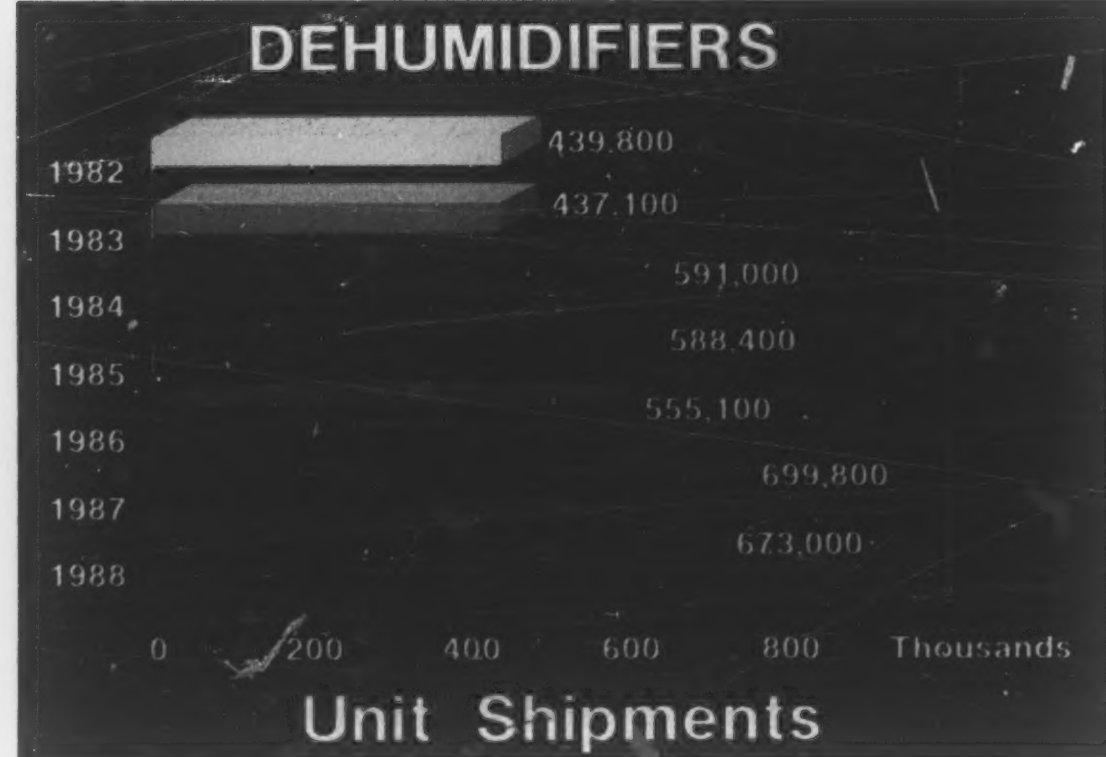
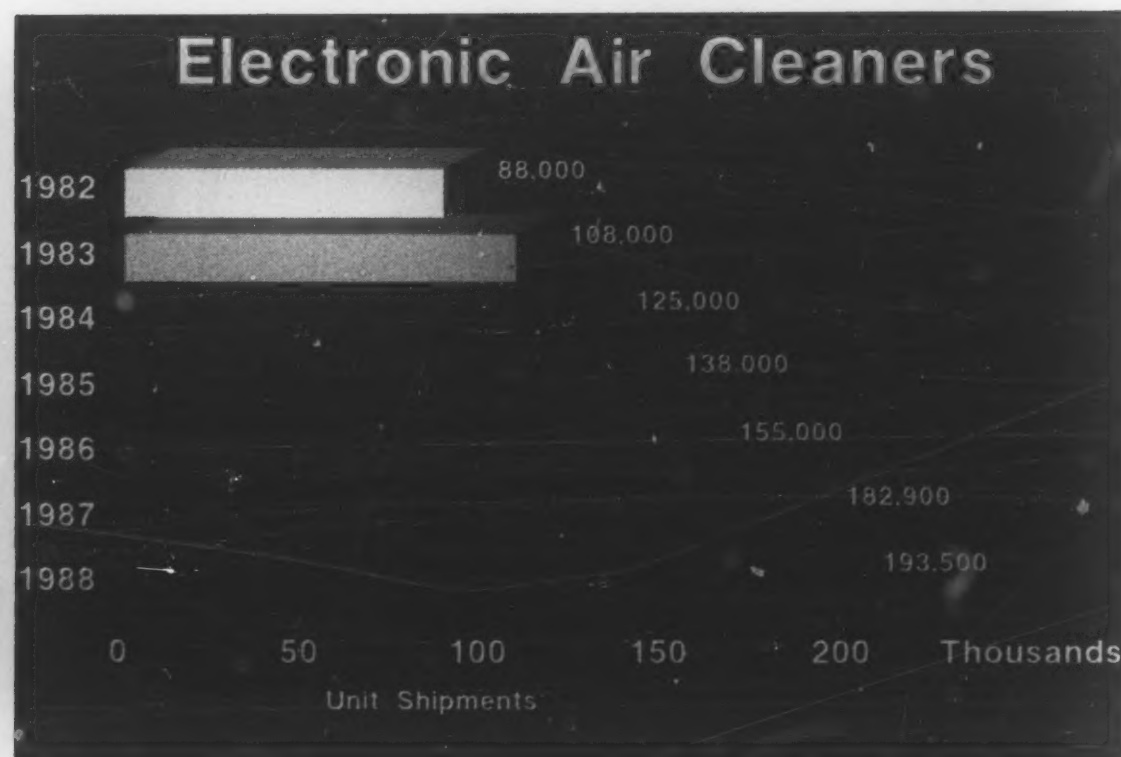
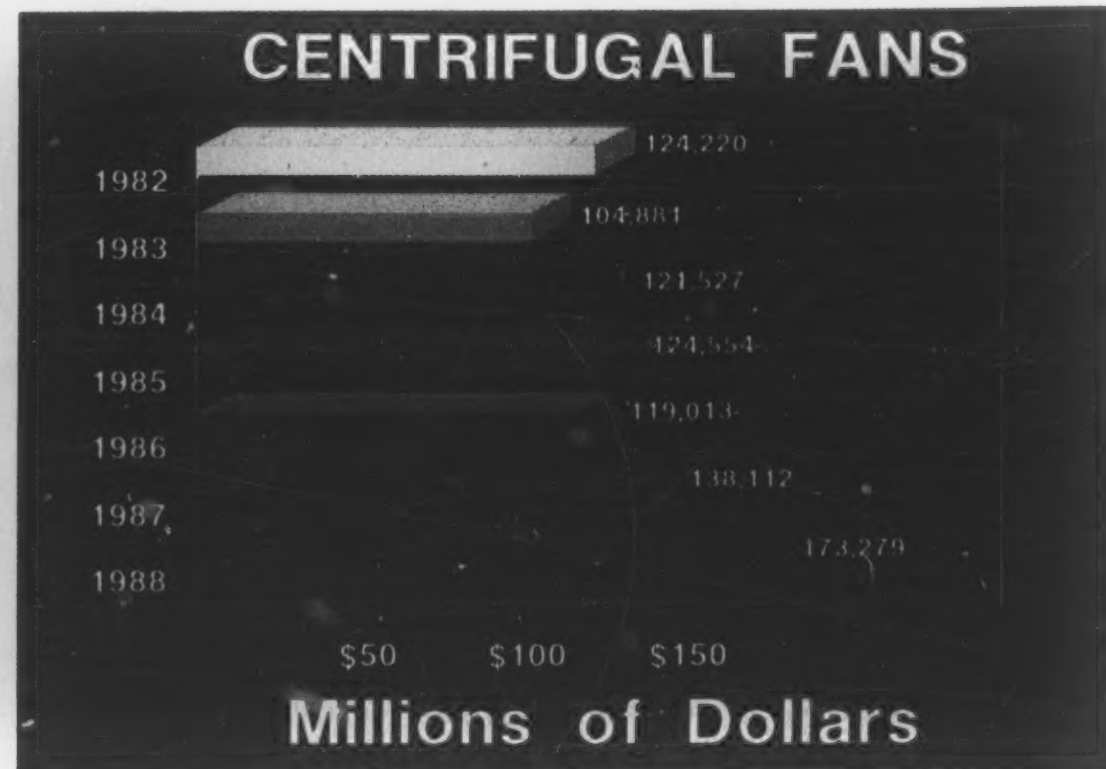
Still over the horizon is another market which, we think, will develop in the early 1990's. It's based on increased consciousness of indoor air quality and the ability of eac's to remove pollen and other irritating airborne particulates.

A major eac producer, Honeywell, believes eac's represent a \$500-million untapped market for contractors. Judging the saturation of eac's at only 5% of U.S. homes, the company has launched a campaign that, within five years, has an objective of including an eac with every fourth furnace, heat pump, or central air conditioner installed.

If successful, that would mean shipments in the order of one million units a year. Already, some merchandising contractors include quotes for eac's and humidifiers with each bid in order to build profit and instill a quality image in the mind of the homeowner.

Dehumidifiers

Shipments of dehumidifiers dropped 3.8% away from the previous year's record pace in 1988 to 673,000 units, according to the Association of Home Appliance



Manufacturers (AHAM). The revised total for 1987 was 699,800 units.

Looking ahead, AHAM's members expect shipments this year will be in the order of 638,000 units, a 5.2% drop from 1988 performance.

For the record, the Bureau of the Census reported that 454,208 dehumidifiers were shipped in 1987, the latest year for which these data are available. That represents a 10.6% decline from the 454,208 units the Bureau said were shipped in 1986.

Pollution control bookings

Sales bookings for industrial air pollution control equipment, which peaked at just over \$1 billion in 1979, spiraled downward until 1986 and now appear to have stabilized at about a quarter of their peak value.

Total bookings in 1988 amounted to \$242 million, up 4.5% from the \$231.7 million total recorded in the previous year. The total for 1985, at the bottom of the

spiral, was \$153 million.

Flue gas desulfurization equipment bookings, at \$45.6 million in 1988, were down 51.9% from the \$94.9 million total for 1987. This volatile market peaked at \$404 million in 1979 and sank to \$8.9 million in 1985.

Bookings for gaseous emission controls in 1988, at \$18.6 million, represented a 127.2% increase over the previous year's total of \$8.2 million.

The booking value for electrostatic precipitators in 1988, at \$115.2 million, was ahead of the previous year's \$73.9-million pace by 55.9%.

Fabric filter bookings, at \$44.9 million last year, were up 4.7% over the 1987 total of \$42.9 million. The 1985 total was \$80 million.

Mechanical collector booking values, at \$2.5 million in 1988, were almost identical to the level achieved by this industry segment in the previous year.

Wet scrubber bookings, at \$15.1

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RELATED PRODUCTS

(Continued from Page 24)

million last year, showed an increase of 62.4% over the \$9.3 million total recorded in 1987.

Canadian sales bookings included: \$22,356,000 for electrostatic precipitators; \$101,000 for fabric filters; \$91,000 for mechanical collectors; and \$1,021,000 for wet scrubbers.

The institute's statistics cover new orders for installation in the U.S. and Canada. All orders include bare flange-to-flange hardware with the exception of flue gas desulphurization equipment, which includes the total contract value.

Refrigerants

U.S. shipments of the three most common fluorocarbon refrigerants — CFC-11, CFC-12, and HCFC-22 — in 1987 totaled 931,403,000 pounds, an increase of 6.3% over the 875,877,000 pounds shipped in the previous year, according to figures released by the U.S. International Trade Commission.

Shipments of CFC-11 last year totaled 223,195,000 pounds, almost even with the previous year's total of 223,401,000 pounds.

Shipments of CFC-12 in 1988 totaled 384,484,000 pounds, an increase of 4.4% from the previous year's total of 368,405,000 pounds.

Shipments of HCFC-22, so designated because it is hydrogenated and mostly breaks down in the lower atmosphere, totaled 323,724,000 pounds in 1988, an increase of 14% over the prior-year total of 284,081,000 pounds.

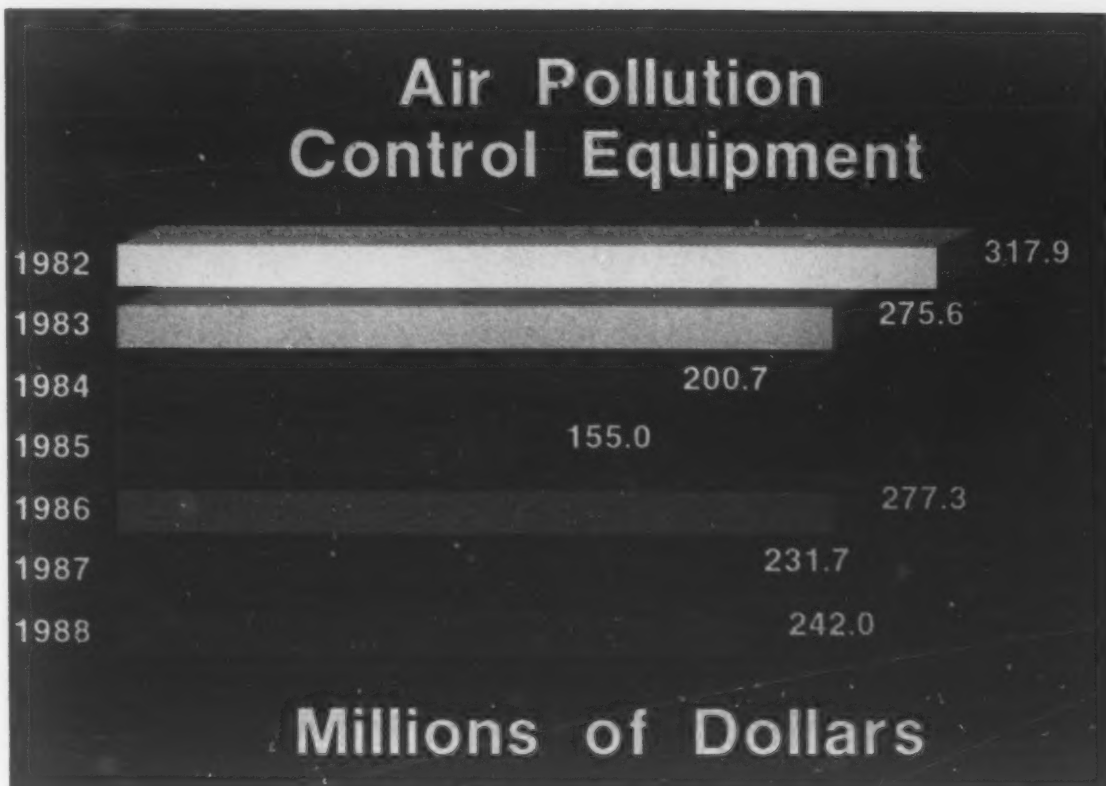
But that is only part of the story. Regulations adopted by the Environmental Protection Agency (EPA) in mid-1988 call for a U.S. production freeze, effective July 1 of this year, of CFCs -11, -12, -113, -114, and -115 at 1986 production levels.

Because the freeze will be at 1986 production levels, that means it will have the effect of a 21.26 million pound — or 9.5% — cut in CFC-11 production from the level of production in 1988. Similarly, CFC-12 production will be cut by 62.14 million pounds — or 16.2% — from the 1988 production level when the freeze takes effect July 1. HCFC-22, seen as part of the solution to the ozone reduction problem, is not affected by the EPA regulations.

In addition to the freeze, the EPA regulations call for a 20% reduction (from 1986 levels) in U.S. production of covered CFCs in 1993 and a 50% cutback in 1998. However, there are strong indications that cuts could be much deeper and much faster than today's regulations would have us believe.

At about this time a year ago, the Ozone Trends Panel (created by NASA in collaboration with the FAA, World Meteorological Association, and the United Nations) confirmed that stratospheric ozone has, in fact, decreased — at some times and places several times faster than predicted.

The conclusion was the result of an accelerated analysis by more than 100 scientists from six nations. It included data quality control, calibration, and error analysis of nearly all ground-based and satellite observations. The panel determined that, since 1979, total ozone has decreased by 5% at all latitudes south of 60° south at all



times of the year.

The discovery of global ozone reduction at a much faster rate than computer models had estimated came hard on the heels of the conclusion that CFCs create the Antarctic ozone hole every October through the interaction of CFC-produced chlorine monoxide and ice crystals. Similar tests conducted at Thule, Greenland, in February, 1988, indicated that the amount of chlorine dioxide in the north polar region was 10 times higher than computer models had predicted.

Almost immediately, Du Pont, which produces 25% of the world's CFCs, and Allied-Signal announced they plan to virtually eliminate the production of fully halogenated CFCs by the end of this century. The former EPA administrator reported that this approach also represented the tenor of EPA's thinking.

The Montreal Protocol, drafted in late 1987 and implemented last year, called for a 50% CFC reduction by 1998 based on the perception that it would limit stratospheric chlorine concentrations to no more than 5 parts/billion, up from 2.7 parts/billion today. The Ozone Trends Panel, however, predicted chlorine concentrations would rise to 8 parts/billion.

Because of the panel's report, the Montreal Protocol's Main Working Group began a reassessment process in October, 1988, with a meeting in The Hague, Netherlands. Several panels were directed to develop a common format for determining the impact of various control measures.

An overall committee is expected to draft amendments by this summer and have them in the hands of protocol signers by September. A vote on the amend-

ments will take place in April, 1990, with implementation the following October.

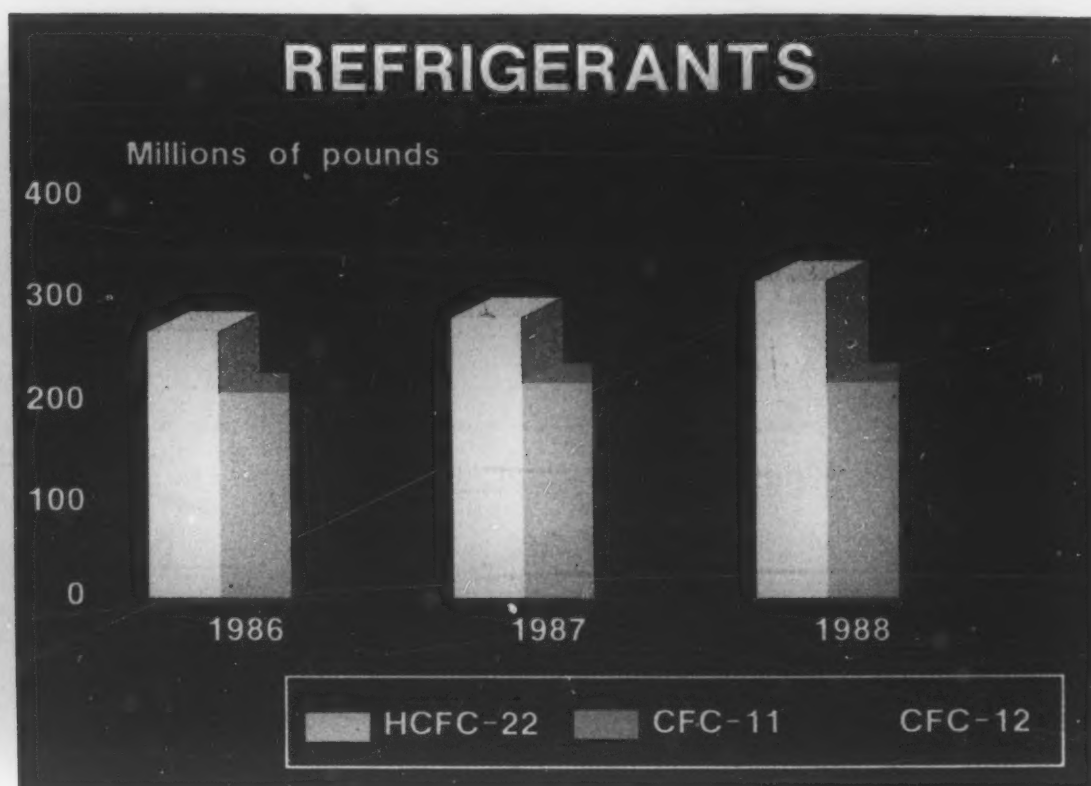
Meanwhile, the 12-nation European Economic Community in early March agreed to reduce CFC use by 85% "as soon as possible," and to phase out CFCs completely by the end of the century. It scheduled a meeting in Helsinki, Finland, in May to consider more severe CFC reductions, and another in London next April to consider all aspects of the Montreal Protocol. A meeting in London last month sponsored by the UN Environment Program examined the CFC problem.

There is considerable activity on the domestic front best followed in the weekly issues of *The News*. The refrigerant producers are developing alternative chemicals which must be thoroughly tested for possible human and equipment problems.

The Air-Conditioning and Refrigeration Institute (ARI), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and National Institute for Standards and Technology are taking leadership roles in establishing standard criteria and disseminating research data.

Most affected by the freeze and cutbacks will be commercial air conditioning chillers, commercial refrigeration systems, mobile refrigeration systems, drinking water coolers, ice makers, auto air conditioning, and household refrigerators and freezers.

Unitary air conditioning and heat pumps will not be affected except for the continuing supply of HCFC-22, which has been made more severe by the fast food industry's decision to switch to that refrigerant as a blowing agent for its many million foam food containers.



COMFORT AND CONSTRUCTION

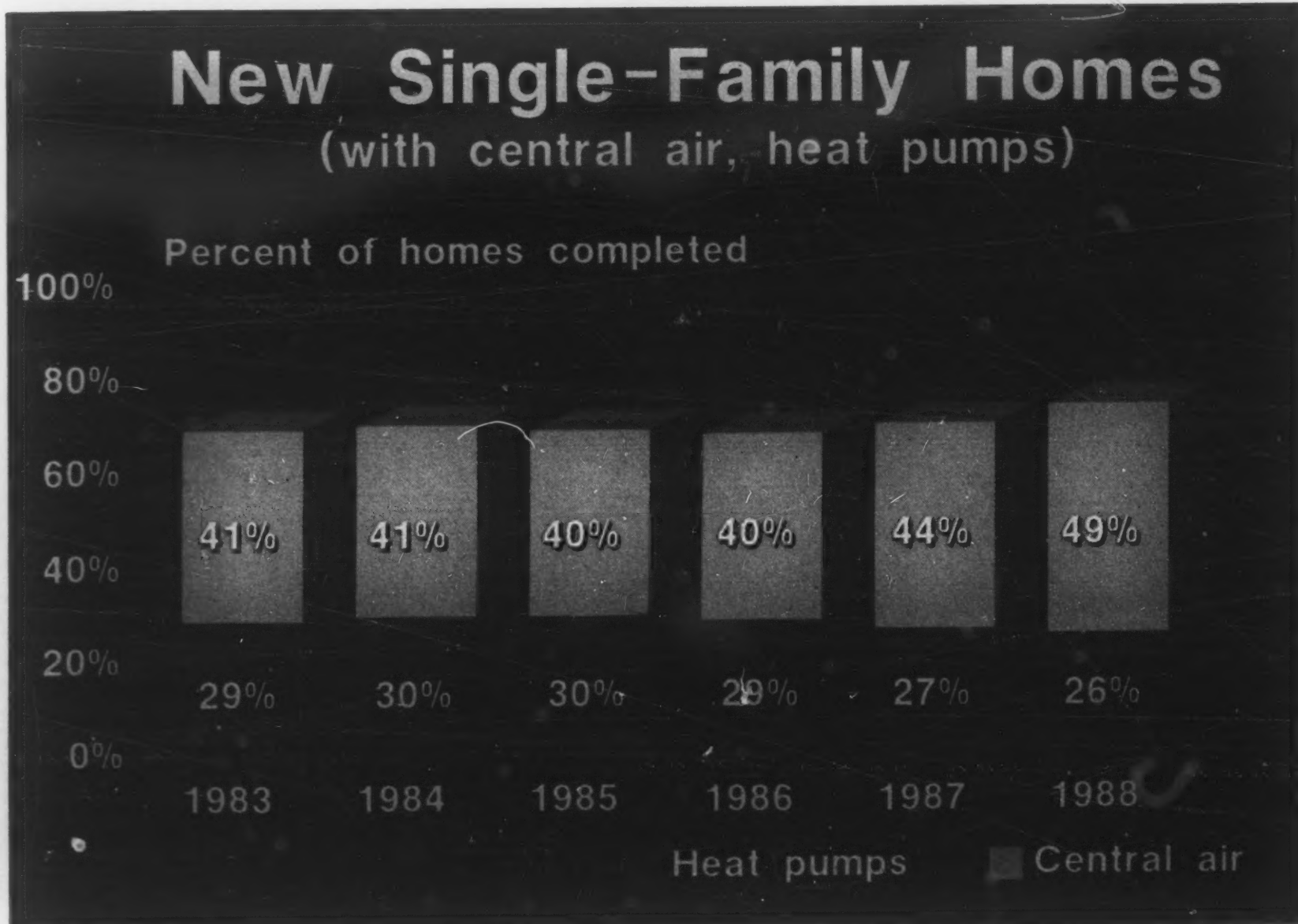
Advancements in technology, supported by a continuing public appetite for improved energy efficiency and comfort, has fundamentally changed the complexion of the hvac industry over the past decade.

It's a change that has dramatically altered both equipment design and the way it is marketed by both manufacturers and contractors. What's more, the evolution is sure to continue unabated.

Initiated by rapid increases in fuel prices that were emphasized by the second oil price shock of 1978, the momentum has carried through the past three years when the prices of natural gas, oil, and electricity have declined. In fact, a substantial new market — replacing inefficient equipment in good working order with high-efficiency units — has developed and continues to flourish.

Back in the early 1970's, the efficiency of an air conditioner, a heat pump, a furnace, or a boiler was mostly an academic consideration. The few who made or mar-

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keted equipment markedly more efficient than that of competitors could find few who appreciated the difference enough to pay the premium cost. Price was supreme and equipment was considered almost a commodity.

But that has changed.

Instead of the atmospheric gas furnace with standing pilot that dominated the market a decade ago, there are three higher efficiency ranges that use electronic ignition, power burners, microelectronic controls, condensing heat exchangers, and new combustion technology to achieve seasonal efficiencies as high as 96%. More than one-third of shipments last year were in the highest two of these categories.

Air conditioners that once competed on the price-induced basis of how little coil surface was needed for a given capacity now use microelectronics, vastly improved compressor and heat exchanger components, and variable-speed drives to achieve efficiencies thought impossible only a decade ago.

Heat pumps, once accepted as necessarily poorer cooling performers than air conditioners because of coil compromises, today have edged out cooling-only units in the efficiency race.

In the case of rooftops and large commercial equipment, advances

in compressors and combustion have been supplemented by more widespread use of microelectronic control systems and variable-speed drives. Integrated controls and personal rather than custom computer controllers promise to restore much of the work formerly handled by control companies to the contractor.

The best is yet to come.

The advent of federal minimum efficiencies for residential heating and cooling equipment in 1992 will set the stage for widespread technological innovation that, today, represents only a small market share. Central air conditioners and heat pumps will have to meet an SEER (seasonal energy efficiency ratio) of at least 10 and heating equipment will have a floor of 78% AFUE (annual fuel utilization efficiency).

There is no doubt the industry will be able to meet these mandatory minimums in time. And early fears that the minimums might become both a floor and a ceiling have dissipated in the face of technological advances already evident. Today's market, for example, offers cooling equipment with SEER's above 17 and heating equipment with AFUE's in the mid 90's.

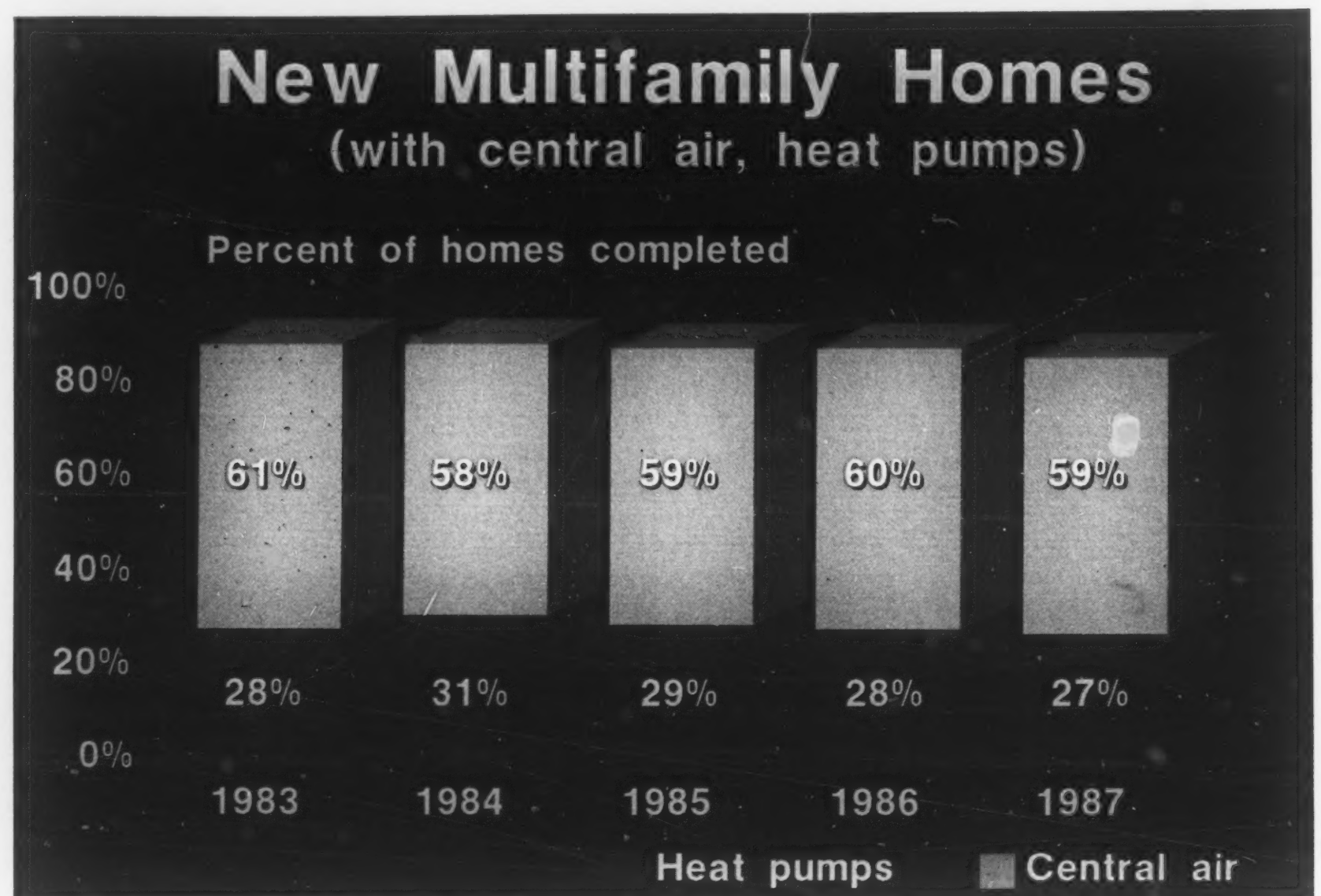
Competition between manufacturers above the mandatory federal minimums appears to be assured. We suspect, however, that we won't get an industry perspec-

tive of that competition until the 1991 and 1992 lines are introduced. The last industry show provided only a few glimpses into

the post-1992 future.

We can, however, look forward to seeing much more extensive use of inverter drives and microelec-

tronics, scroll, screw, and innovative rotary compressors replacing reciprocating designs, enhanced heat exchangers and combustion



Heating-cooling-fuel new home characteristics

	1987					1988				
	U.S. total	Northeast	Midwest	South	West	U.S. total	Northeast	Midwest	South	West
Single-family homes completed	1,123,000	196,000	201,000	467,000	259,000	1,083,000	187,000	191,000	456,000	249,000
		17.5%	17.9%	41.6%	23%		17.3%	17.6%	42.1%	23%
Space heating fuel										
Gas	583,000	87,000	166,000	154,000	176,000	586,000	85,000	161,000	163,000	177,000
	51.9%	44.4%	82.6%	33%	68%	54.1%	45.5%	84.3%	35.8%	71%
Electricity	445,000	52,000	26,000	303,000	64,000	400,000	44,000	22,000	281,000	53,000
	39.6%	26.5%	12.9%	64.9%	24.7%	36.9%	23.5%	11.5%	61.6%	21.3%
Oil	58,000	52,000	3,000	—	—	60,000	56,000	—	3,000	—
	5.2%	26.5%	1.5%	—	—	5.5%	30%	—	0.7%	—
Other/none	38,000	5,000	6,000	8,000	19,000	36,000	3,000	6,000	9,000	18,000
	3.4%	2.6%	3%	1.7%	7.3%	3.3%	1.6%	3.1%	2%	7.2%
Heating system type										
Central heating	1,022,000	169,000	191,000	437,000	224,000	1,001,000	169,000	183,000	429,000	219,000
	91%	86.2%	95%	93.6%	86.5%	94.2%	90.4%	95.8%	94%	88%
Warm air ducted	943,000	98,000	187,000	436,000	222,000	926,000	105,000	178,000	428,000	215,000
	84%	50%	93%	93.4%	85.7%	85.5%	56.2%	93.2%	93.9%	86.4%
Warm air furnace	640,000	70,000	175,000	212,000	184,000	647,000	80,000	167,000	214,000	186,000
	57%	35.7%	87%	45.4%	71%	59.7%	42.8%	87.4%	46.9%	74.7%
Heat pump	303,000	28,000	13,000	224,000	38,000	279,000	25,000	11,000	213,000	30,000
	27%	14.3%	6.5%	48%	14.7%	25.8%	13.4%	5.8%	46.7%	12%
Hydronic	78,000	71,000	4,000	—	—	74,000	64,000	5,000	—	3,000
	7%	36.2%	2%	—	—	6.8%	34.2%	2.6%	—	1.2%
Built-in	101,000	27,000	10,000	30,000	34,000	82,000	18,000	7,000	26,000	30,000
	9%	13.8%	5%	6.4%	13.1%	7.6%	9.6%	3.7%	5.7%	12%
Electric	57,000	23,000	7,000	15,000	12,000	43,000	16,000	4,000	13,000	10,000
	5%	11.7%	3.5%	3.2%	4.6%	4%	8.6%	2%	2.9%	4%
Other/none	44,000	4,000	3,000	15,000	22,000	38,000	—	3,000	13,000	20,000
	3.9%	2%	1.5%	3.2%	8.5%	3.5%	—	1.6%	2.9%	8%
With central air conditioning	801,000	94,000	134,000	432,000	141,000	809,000	98,000	136,000	426,000	149,000
	71.3%	48%	66.7%	92.5%	54.4%	74.7%	52.4%	71.2%	93.4%	59.8%
Multifamily homes completed	546,000	62,000	101,000	193,000	190,000	445,000	63,000	89,000	138,000	156,000
		11.4%	18.5%	35.4%	34.8%		14.2%	20%	31%	35%
Space heating fuel										
Gas	223,000	36,000	62,000	29,000	95,000	196,000	40,000	56,000	20,000	80,000
	40.8%	58%	61.4%	15%	50%	44%	63.5%	62.9%	14.5%	51.3%
Electricity	307,000	18,000	37,000	162,000	89,000	238,000	18,000	32,000	117,000	70,000
	56.2%	29%	36.6%	83.9%	46.8%	53.5%	28.6%	36%	84.8%	44.9%
Oil	5,000	5,000	—	—	—	4,000	3,000	—	—	—
	0.9%	8%	—	—	—	0.9%	4.8%	—	—	—
Other/none	12,000	2,000	—	2,000	6,000	7,000	1,000	1,000	—	5,000
	2.2%	3.2%	—	1%	3.2%	1.6%	1.6%	1.1%	—	3.2%
With air conditioning	471,000	51,000	95,000	191,000	134,000	375,000	55,000	85,000	136,000	99,000
	86.3%	82.3%	94%	99%	70.5%	84.3%	87.3%	95.5%	98.6%	63.5%

SOURCE: Census Bureau. All numbers are rounded. Built-in "electric" includes electric baseboard, panel, or radiant heat. Built-in "other" includes room or space heaters, floor or wall furnaces, solar, and other types of heating.

COMFORT AND CONSTRUCTION

techniques, and more integration of comfort and domestic hot water systems.

Contractor role

Assured also is the fact that the world of the contractor will also change dramatically, particularly those who have been slow to accept the changes to date. Training in new equipment installation and service will be vital. The alternative will be the second-class role of restricting service operations to older equipment.

Contractor marketing also is taking on a new dimension. Instead of waiting for the telephone to ring, an increasing number of contractors are developing marketing plans aimed at flushing out residential and commercial owners who can be sold on upgrading inefficient equipment.

We believe that these contractors, many of whom are being assisted materially by manufacturer principals, will quickly dominate local markets within a few years. No longer will service be the overwhelming source of replacement sales. How far and how fast this new breed of merchandising contractor will go, however, is bound to be limited by the availability of trained technicians.

A quick history

In the years immediately following the Arab oil embargo of 1973, the avoidance of high fuel bills took the form of added insulation, weatherization, the elimination of pilots on gas-fired equipment, more coil surface on air conditioners and heat pumps, and an interest in solar, wood, and other renewable resources.

The adoption of new technology, coupled with a consumer willingness to pay a premium for increased efficiency, had its beginnings in 1979 but did not fully develop until 1984. No longer were furnaces considered extensions of the ductwork, nor was there competition to see how little coil surface was needed for a given capacity.

Today, the education of both the consumer and the government is well advanced. In a 1988 survey conducted by the National Association of Home Builders (NAHB), for example, 69% of those who have purchased homes since 1980 listed energy features as a "very important" factor in their home buying decision.

There are also a few clouds. The industry's technical society still is bogged down in its efforts to update energy standards for new buildings that are used as a basis for a wide range of state and local codes.

The restricted availability of some fluorocarbon refrigerants, which becomes effective July 1, will have a mixed effect on the indoor comfort industry. Affected most will be the 60,000 installed centrifugal chillers that use either CFC-11 or, in much fewer instances, CFC-12. HCFC-22, which is used in nearly all unitary air conditioners and heat pumps, will be unaffected.

Heating

In the days of cheap and abundant natural gas, there was little incentive to install anything but an inherently reliable and inexpensive atmospheric furnace or

boiler with a standing pilot. The natural venting arrangement meant that conditioned air was lost up the flue whether the unit was operating or not. The pilot often burned all summer to keep dampness from the simple clamshell heat exchanger.

These units had a steady state efficiency of at least 80% but, on an annual basis, they were hard pressed to top 60%.

The steep price increases following gas decontrol in 1978, and some state laws, brought the replacement of the standing pilot with an intermittent ignition device (iid) to increase seasonal efficiencies to the 67% to 71% range. A vent damper, which reduced the amount of conditioned air vented between cycles, added another 8%

or so.

Next came a family of gas-fired equipment which used power burners, induced draft, or recuperative heat exchangers. They stopped just short of condensing the flue gases and produced annual efficiencies in the 80% to 86% range.

A pulse combustion boiler was introduced in 1980 and, two years later, it was joined by a pulse combustion furnace. Both had seasonal efficiencies above 90%. Within three years, virtually every manufacturer offered a condensing furnace with annual efficiencies above 90% and another efficiency class was born.

Some problems

These changes were not without

incident. The corrosive nature of flue gas condensate, plus the corrosive chemicals introduced into the home environment from such things as cleaning compounds, caused many problems with early installations. Even furnaces that were not designed to condense flue gases did so under certain conditions.

Concentrated industry research has removed most of these early problems. Superior stainless steel alloys are used in secondary heat exchangers. New venting standards have been developed. Some use outdoor air for combustion. And contractor training has advanced substantially.

A survey of 215 condensing furnace owners conducted for the Canadian Electrical Association

by the Ontario Research Foundation revealed that 59% reported improved comfort. The 8.4% who had comfort complaints mostly listed cool or drafty conditions or excessive indoor humidity.

The most frequent operational complaints (17% each) were ice build-up at the vent and noise. The most common repairs or adjustments were electrical controls (21%); induction fan (14%); and ignition (12%).

The efficiency market

Although some were unaware of it at first, there was a comparatively large group of homeowners eager to control their energy bills. They watched the evolution in efficiencies with more than passing

(Next Page, Please)

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COMFORT AND CONSTRUCTION

(Continued from Preceding Page)

interest. When they began replacing furnaces and boilers in good working order with high-efficiency units, a whole new market was born.

The market has been growing steadily since 1983 and has required a change in contractor thinking. Instead of trying to make older inefficient equipment work a little longer, they are convincing customers that it's wiser to replace it and save on energy bills. Importantly, this business is inherently more profitable for contractors and often takes them out of price competition with "fix-it" contractors.

A breakdown of manufacturer shipments by efficiency range reported by the Gas Appliance

Manufacturers Association (GAMA) illustrates the scope of the change. The report includes upflow, downflow, and horizontal furnaces.

Last year, furnaces with AFUE's of less than 65% — the standard for a quarter century — accounted for only 9.9% of total shipments, down from 11% a year earlier. They accounted for 206,460 of the 2,092,092-unit total.

At the other end of the spectrum, 35.3% of the total in 1988, or 740,644 units, had AFUE's of 80% or better, up from 33% a year earlier. Of these, 17.1% (or 358,982 furnaces) had AFUE's of 86% or better, up from 16.1% in 1987.

In between these two extremes, 38.6% of the furnaces shipped last

year, or 808,285 units, had efficiencies of more than 65% but less than 71%, down from 41.5% a year earlier. Similarly, 16.1% of shipments in 1988, or 336,703 units, had efficiencies of 71% or more but less than 80%, up from 14.5% the year before.

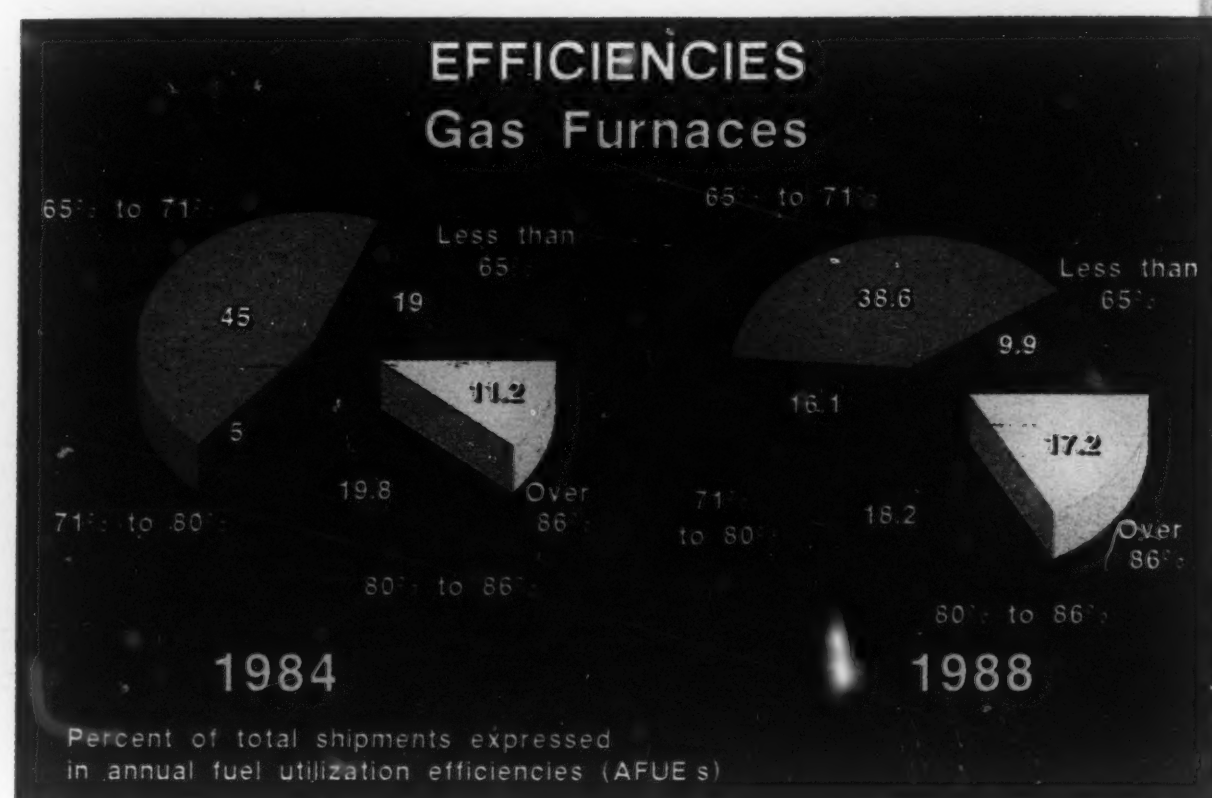
The picture for oil furnaces, also reported by GAMA, revealed that 67.3% of the oil furnaces shipped last year, or 137,022 units, had AFUE's of 80% or more, up from 55.4% in 1987. Another 30.9% of shipments last year, or 63,004 units, had AFUE's of 75% to less than 80%, the same as for 1987. Only 1.8% of the oil furnaces shipped last year, or 3,757 units, had AFUE's below 75%, down from 5.3% in 1987.

Overall, then, more than one-third of gas furnaces and more than two-thirds of oil furnaces already exceed the minimums mandated for 1992. Here again, enough room has been left so that competition above that level is assured. To date, most of the high-efficiency gas furnaces have been installed in existing homes.

It should be noted that mobile home furnaces have been granted an exception to the 78% minimum AFUE effective with units manufactured in 1992. The minimum for mobile home units is 75% AFUE.

The industry still debates whether or not it's best to use outdoor air for combustion. Air-to-air heat exchangers, used more extensively in Canada and in Scandinavia to maintain ventilation and reduce humidity in tightly insulated homes, have not been widely accepted in the U.S. And work continues on getting local code approvals for plastic gas distribution piping within structures.

The days have long gone when the trend was toward smaller and



smaller condenser coil surfaces and higher and higher fan speeds to achieve the best price in a market dominated by builder purchases.

As electricity bills spiraled upward, particularly in the South where cooling seasons are long, units destined for the more discerning add-on and replacement markets were quieter and more efficient. And, as home buyers became more aware of energy costs, more and more builders began opting for higher efficiencies as part of an energy saving merchandising package.

Today, at a time when replacements and add-ons represent more than twice the share of residential new construction and half of commercial units are replacements, energy efficiency has taken on much more importance.

Within the industry, condenser surfaces were first expanded and, in recent years, contracted as enhanced fin surfaces and turbulent-flow tubing designs were devel-

oped. Multiple-speed reciprocating compressors and condenser fan motors came into play. Compressor sizes were reduced and, within the past two years, scroll compressors were introduced in significant numbers. Sound levels were reduced dramatically.

Commercial units today are routinely equipped with multiple compressors to provide more modulation and, as a side benefit, lower cost because of the economies of scale in the manufacture of smaller compressors. Scroll compressors are being used increasingly in smaller tonnage ranges while, in larger applications, screw compressors are being introduced.

The price of variable-speed drives for compressors, fans, and blowers has become affordable and, we suspect, a growing number of manufacturers are testing prototypes to compete with the few models now on the market.

Humidity control, a casualty among some of the early high-efficiency air conditioners, is better understood by both manufacturers and contractors. The combination of variable speeds and microprocessor controls holds the promise of all but eliminating this criticism.

Until 1976, we doubt that more than 15% of residential units (65,000 Btuh and under) shipped could be classified as high-efficiency units. At that time, an EER of 7.5 was posted by us as the dividing line. That picture has changed dramatically.

The Air-Conditioning and Refrigeration Institute (ARI) reported that, of 1988 shipments of unitary air conditioners in this class, the sales-weighted average SEER was 9.11, up from 8.97 a year earlier.

Looked at another way, 99.7% of the residential central air conditioners shipped last year had an SEER of 7.5 or better. Only 0.3% were below what we considered the high-efficiency line 12 years before.

Further, 53.9% of central residential cooling units shipped last year had SEER's of 9 or better. That included 15.5% of total shipments that boasted SEER's of 10 or better, or above the mandatory federal minimum standard that becomes effective in 1992.

A major benefit of the federal mandate will be the elimination of state minimums. Not only have these state minimums created a number of minimarkets that destroy the economies of scale, but the "me, too" and "me toughest"

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leapfrog syndromes promised much worse conditions in the future.

More important than state minimums in promoting higher cooling efficiencies and associated premium costs have been the many incentive programs launched by summer-peaking utilities seeking to postpone the addition of more generating capacity. They find a \$300 to \$600 incentive for high-efficiency equipment less expensive than \$1,500 a peak kilowatt for new capacity.

At its peak, more than 50 electric utilities offered incentives of some type. We believe that number has dropped somewhat even as new programs have begun. In some cases, the utilities dropped incentive programs when they felt their objectives had been achieved. Others tell us that overall efficiencies have improved to a point where market forces are doing the job for them.

The number of gas utilities offering incentives is much smaller and, for the most part, they have taken the form of no- or low-interest loans. The fuel oil and LP gas industries, to the best of our knowledge, have not offered any efficiency incentives.

Heat pumps

Electric furnaces for many years merely replaced electric resistance baseboard and ceiling cable so that ducted central cooling could also be provided. In the 1980's, however, they have been playing second fiddle to the heat pump.

Even though heat pumps have captured more than a quarter of new single-family home starts in recent years, that share eroded in 1988 for the fourth year in a row to 25.8% of completions. Heat pump penetration in new multifamily units fared a bit better at 27.1%.

This erosion is due primarily to the steep slide in new home starts in the South (from a 56% share of the national total to 38%), where nearly half of new-construction heat pumps are installed. The effects of electricity prices or competition from other fuels have been minor.

The initial reason for the popularity of the air-to-air heat pump was the lack of natural gas availability in many markets until deregulation in 1978. When gas became plentiful, it suffered from steep price increases and a weak infrastructure in the growth markets of the South.

Heat pumps still are largely a South phenomenon, as are electric furnaces. The furnaces tend to be used as sole heat source in the South and as a back-up heat source in the North. Both are favored when cooling seasons are long and when heating requirements are minimal.

A small market that surged briefly and then declined was the replacement of split-system air conditioners with heat pumps on gas and oil furnaces. The heat pump provides summer cooling and heating during the spring and fall. The furnace takes over for the winter. The switching point depends on relative fuel prices.

Contractors continue to report that, in areas where utility incentives reduce the premium, heat pumps still are replacing worn out or inefficient air conditioners. We believe, however, that the prac-

tice is spotty.

A new approach, the integrated system, is enabling gas utilities to compete with heat pumps in some markets. It consists of a gas-fired hot water heater that provides both domestic hot water and space heating. An air conditioning evaporator can be added to the hot water coil in the separate air handler to provide cooling.

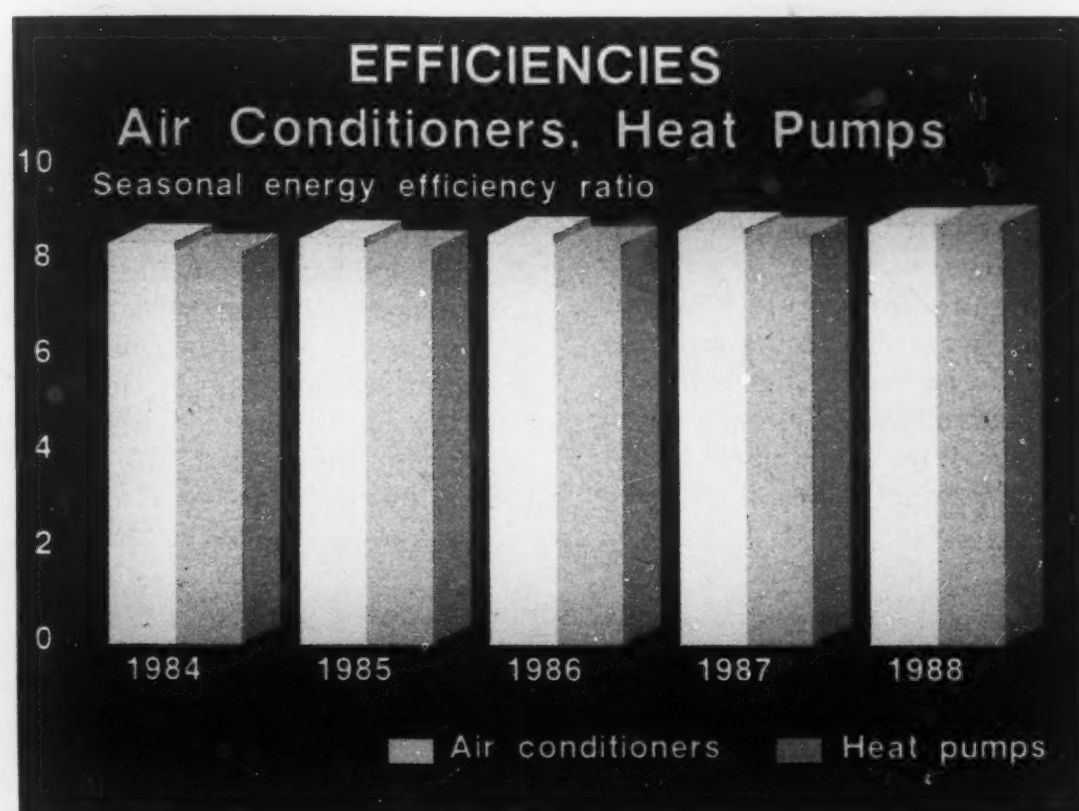
Although these systems have yet to impact on heat pumps nationally, they have enabled gas utilities to regain some of the apartment and condominium market share lost when rising fuel prices prompted developers to use separate comfort systems along with separate meters. The gas industry, too, continues to push development of a gas-fired heat pump.

The performance of air-to-air heat pumps has improved to a point where, in 1988, the 9.13 SEER sales-weighted average for all unitary heat pumps with capacities of 65,000 Btuh or less edged ahead of the 9.11 SEER average for their cooling-only cousins. That's an improvement from 8.93 SEER in 1987.

Looked at another way, 99.4% of the residential heat pumps shipped last year had an SEER of at least 7.5. More than six of 10 (60.7%) could claim an SEER of 9 or better and 8.2%, or 67,356 heat pumps, topped the 10 SEER minimum efficiency mandated for 1992 for split systems (9.7 SEER for single packages in 1993).

It's significant that replacement air-to-air heat pumps, which by

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COMFORT AND CONSTRUCTION

(Continued from Preceding Page)

our calculations did not cross the 100,000 threshold until 1985, topped 250,000 last year, more than one-third of residential installations.

Though their numbers are much smaller, water-source heat pumps using closed earth-coupled loops have been making themselves felt in northern markets, particularly in the Midwest. They have been

used in the South, particularly in Florida where earth-coupled loops are unnecessary, for many years.

Building on current technological trends and competition among manufacturers, the heat pump should experience even higher efficiencies over the next five years, according to Tom Morron, vice president, marketing, at the Edison Electric Institute (EEI).

Between now and the mid-1990's, he expects:

- Scroll compressors will be widely used because of their added durability, efficiency advantage over reciprocating compressors, and quieter operation.

- Variable-speed compressor and fan motors will become more common, providing greater comfort, efficiency, and quieter operation.

- The combining of variable speeds and scroll compressors will make heat pumps more effective in northern climates as well as adding to their popularity in the South.

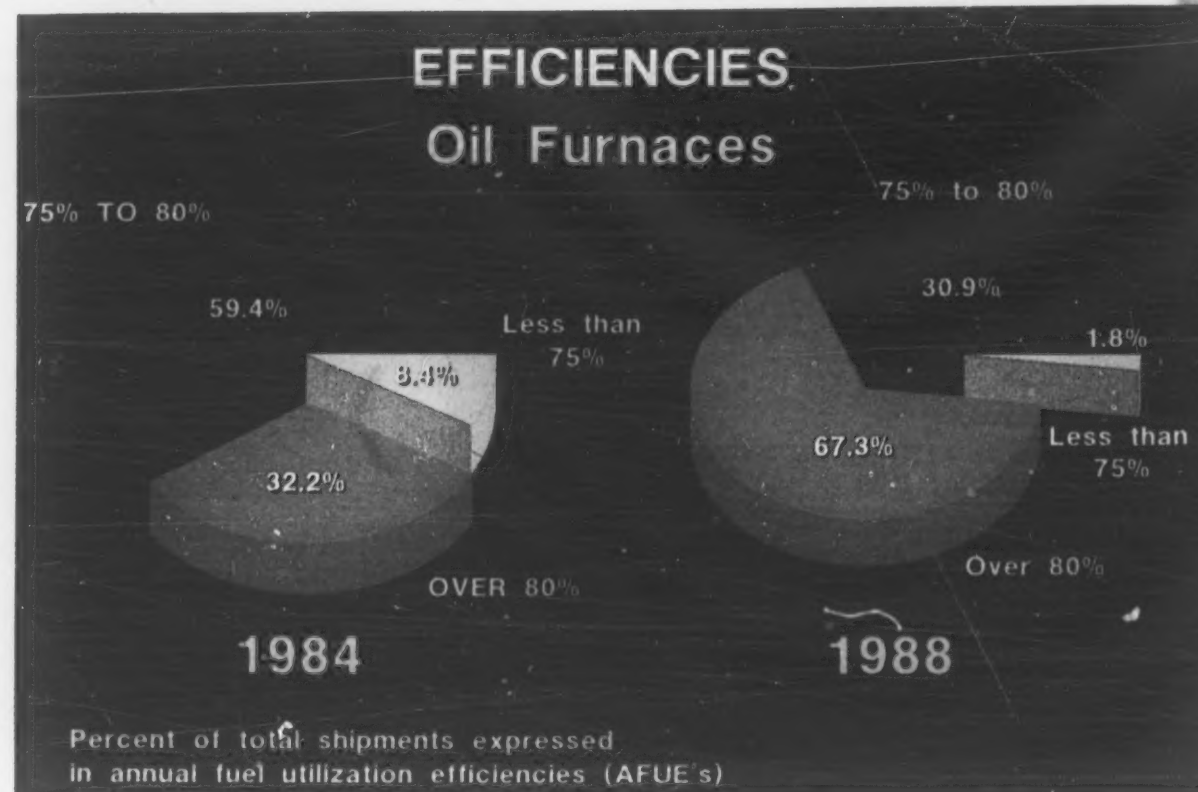
- Changing customer attitudes on long-term paybacks will influence their acceptance of heat pumps offering SEER's above 15 and HSPF's (heating seasonal performance factor) above 12.

- Integrated heat pumps combining space heating and cooling and domestic hot water heating will become more popular because of energy cost savings.

- Cost reductions sparked by increased competition will help increase the number of earth-coupled heat pumps installed.

1988 housing characteristics

Because of exceptional cooperation by the Bureau of the Census, we are able to provide full 1988 and 1987 housing characteristic figures (elsewhere in this issue). In the past, we have had to be con-



tent with the first three quarters of the prior year and the last quarter of the year before that.

The tables also provide a regional breakdown, a necessary addition for a nation of sharp regional disparities. It's also important to note that these figures are based on home completions, not on home starts. The total number of completions is not particularly relevant. The ratios are:

Looking at fuels for single-family homes, the share for gas has escalated steadily from 43.4% in 1985 to 51.9% in 1987 to 54.1%

last year. Oil's share has risen from 2.6% in 1985 to 5.2% in 1987 and 5.5% last year.

Both gains have come mostly from electricity, which declined from 49.9% in 1985 to 39.6% in 1987 and 36.9% last year. Other fuels also declined from 4.1% in 1985 to 3.4% in 1987 and 3.3% last year.

Much the same story was true for multifamily home completions. The gas share escalated from 30.2% in 1985 to 40.8% in 1987 and 44% last year. The electricity (Page 41, Please)

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Only a few bright spots in bleak commercial market

If it were not for the continuing strength of renovations, the outlook for nonresidential construction in 1989 would be bleak.

The only rising stars this year are industrial construction, where restructuring and exports have spawned a need for more capacity, and elementary schools to house the "echo" surge of baby boom children. And the demand for nursing homes will keep the institutional market even.

But two markets of particular importance to the hvac industry — office buildings and retail establishments — lost ground in 1988 and face even sharper declines this year. A turnaround is not expected until 1991.

Renovations and replacements, which now account for half of hvac equipment shipments to these markets, should remove much of the sting, however.

With industrial capacity nudging the critical 85% action level late in 1988, the nation's manufacturers upgraded new plant requirements. The increase this year, from 155- to 175-million square feet, is forecast by F.W. Dodge at 13%.

It should be noted, however, that this optimistic forecast could be dampened by a slowdown in the economy or a significant increase in bond market interest rates.

Institutional building in 1989 is characterized by more elementary schools and nursing homes, fewer colleges and hospitals. The total is expected to decline 6% this year, from 345 million sq ft in 1988 to 325 million sq ft.

During a four-year boom period

from 1983 through 1986, enough offices, apartments, and hotels were built to satisfy normal requirements for more than five years. A major driving force was tax-shelter-oriented construction that often was not related to demand.

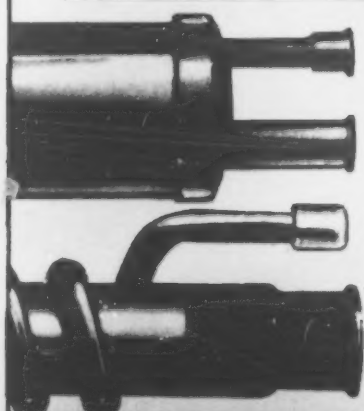
The Tax Reform Act ended tax advantages and, even though the construction rate in 1988 was at only 60% of 1985's peak, national office vacancy rates (19%) have only started to come down. Construction in the Northeast and Midwest, which kept the slide from becoming even steeper, also slackened in 1988.

The outlook for office buildings, according to F.W. Dodge, is for an additional 19% decline from 235 million sq ft in 1988 to 190 million sq ft. Although hotel and motel construction is expected to decline as much as 10% this year, resort hotel construction should increase.

The construction of new stores, shopping malls, and other retail space, has tracked a few paces behind new home building. And, as new home construction has declined from the 1986 peak in this decade, retail construction is feeling the effect.

This market, only slightly overbuilt, experienced only a slight decline in 1988. This year, however, the drop will be a more precipitous 23%, from 545 million sq ft in 1988 to 420 million sq ft this year. An additional decline of as much as 10% is expected next year.

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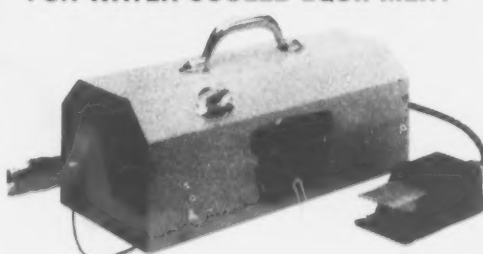
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COMFORT AND CONSTRUCTION

(Continued from Page 32)

share declined from 68.7% in 1985 to 56.2% in 1987 and 53.5% last year. Oil rose from 0.2% of multifamily completions in 1985 to 0.9% in both 1987 and 1988.

The shifts, we believe, are due to both geography and fuel price changes. Most of the gains for gas and oil over electricity, we believe, have come about because of the reduction in construction in the South, bastion of the heat pump and electric heat, and the increases in the Northeast, bastion of oil, and the Midwest, bastion of gas. A significant reduction in oil prices since late 1985 has helped oil's modest share.

The penetration of central air conditioning in single-family homes completed last year was 74.7%, up from 71.3% in 1987. The increase from the plateau of about 70% that has held for several years could be due, in large measure, to two hot summers in a row for much of the country.

Air conditioning in multifamily units declined from 86.3% in 1987 to 84.3% last year, due largely to a drop in penetration in the West (from 70.5% in 1987 to 63.5% last year). Both the Northeast and Midwest registered gains while the South stayed even.

Significantly, the penetration of central air conditioning in new single-family homes continued to increase across the country. Last year's rates: Northeast 52.4%, up from 48% in 1987; Midwest 71.2%, up from 66.7%; South 93.4%, up from 92.5%; and West 59.8%, up from 54.4%.

The penetration of heat pumps in single-family homes slipped again last year, from 27% in 1987 to 25.8% in 1988. It had been 30% in 1985. Although the other three regions dropped marginally, the West declined from 14.7% to 12%.

The preference for hydronic systems, at 6.8% of new single-family home starts last year, was down a hair from the 7% recorded a year earlier. Minor losses in the Northeast and Midwest were not quite counterbalanced by an increase in the West.

The warm air furnace share of new single-family homes completed in 1988, at 59.7%, was ahead of the 57% rate posted a year earlier. The gains came in the Northeast and in the West.

In a related report, we have noted that central air conditioning penetration in mobile/manufactured homes in 1987 was 49%, up from 48% in the previous year. Regionally in 1987, it broke down like this: Northeast 14%; Midwest 38%; South 60%; and West 34%.

HOUSING AND CONSTRUCTION

The new home market, which led the nation's economy out of the recession in 1982 and prospered for four years, has weakened since 1986 and shows signs of bottoming out this year. The totals, while still respectable, mask regional disparities and a drop in multifamily starts that has far outpaced the modest decline of single-family home construction.

Total private housing starts in 1988 amounted to 1,487,700 units, down 8.2% from the 1,620,500 new homes started in the previous year. The 1987 total was down 10.2% from the decade's peak of 1,805,400 units in 1986.

That's only part of the story. Single-family home construction, led by a strong trade-up segment favoring large custom

homes, totaled 1,080,000 units last year. It was the sixth year in a row that this sector topped the one-million mark. The decline in 1988 was 5.8% from a prior-year total of 1,146,400 units. In 1987, single-family starts dropped only 2.8% from a 1986 peak of 1,179,100 units.

Multifamily starts, affected severely by tax law changes and vacancy rates that persist in the 8% range, totaled 407,700 units in 1988, down 14.2% from the previous year's total of 474,100 units. The decline last year followed a precipitous 24.3% fall in 1987 from the 1986 peak of 626,000 multifamily units.

On a regional basis, the boom in the Northeast is plainly over. Total starts for this region in 1988,

at 235,300 units (18.3% of the total market), were down 12.5% from the 269,000-unit total of the previous year. The decline in 1987 was 8.4%. Although "bust" is much too harsh a term, high home prices and serviced land scarcity have combined with overbuilding to cool off this previously hot market.

Starts in the Midwest, at 272,600 units last year (18.3% of the total market), declined in concert with the total housing market, at 8.5%, from 297,900 units in the previous year. Helped by a restructured manufacturing industry and a surge in exports, the former "rust belt" states held even in 1987 with the prior year's peak of

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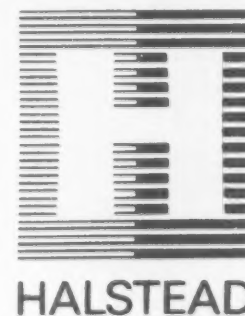
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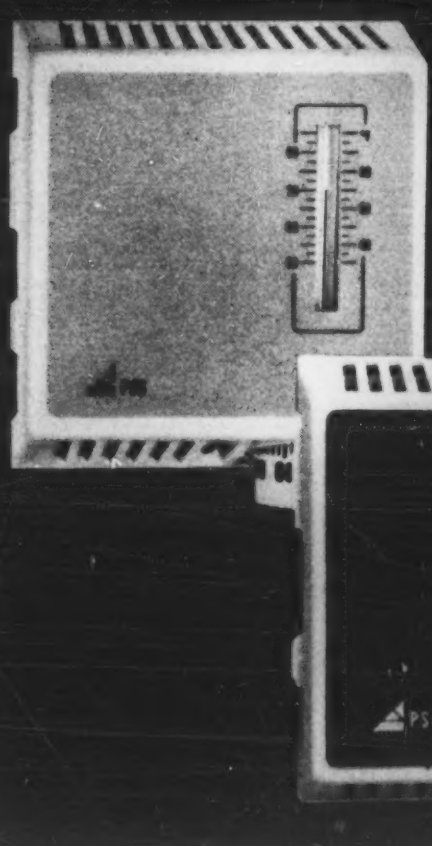
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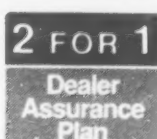
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HOUSING AND CONSTRUCTION

(Continued from Preceding Page)

295,800 units.

The South, which as late as 1983 enjoyed a 56% share of the national housing market, registered its fifth decline in a row last year. Starts in 1988 totaled 574,700 units (38.7% of the total market), down 9.3% from the 1987 total of 633,900 units. That was less than the 13.5% drop in 1987. There are signs that this market, dragged down by a recession in the "oil patch" states, may be stabilizing.

Home construction in the West, led by strong California and Nevada markets, demonstrated the smallest decline last year. Total starts, at 404,500 units (27.2% of the total market), declined by 3.6% from the prior-year total of 419,800 units. The decrease in 1987, however, was 13% below the 1986 peak of 483,000 units.

1989 forecast

Continued slow growth in the economy, coupled with rising mortgage interest rates and high vacancy rates among multifamily rental units, will mean another down year for new home construction. The overall decline, however, should be relatively modest.

Looking ahead, we expect overbuilding and high home prices (33% greater than the U.S. median) will take another 13% toll on total housing starts in the Northeast. The bright spots will be New York City, the nation's capital, Philadelphia, Pittsburgh, Buffalo, and Rochester.

Declines in the Midwest and in the South should only be half that much. Starts in the eastern half of the Midwest will fare best. While performance in the South Atlantic states continues reasonably strong, the oil patch states of Texas, Oklahoma, and Louisiana have yet to show signs of coming back. Texas, which once accounted for 20% of the nation's starts, continues at 5%.

Strong single-family construction markets in California, Nevada, and other Pacific coastal states is expected to keep the decline in the West to about 5%. Housing markets in the Mountain states, which have suffered during the past two years, are expected to rebound in 1989.

Taken as a whole, we expect single-family home starts in 1989 will decline by 9.7% to 975,000 units. That's a bit more conservative than the forecast by the National Association of Home Builders (NAHB). We put more stock in the effect of higher interest rates and the mortgage market disruptions caused by the crisis among savings and loan institutions.

The multifamily market, hit hard by tax shelter-inspired overbuilding in the 1985-1986 period, probably will hit bottom this year. Even so, we expect the decline to be in the order of another 14% drop to 350,000 units — also more conservative than NAHB's forecast of 370,000 units.

National vacancy rates continue in the 8% range and, we believe, it will take another year before developers regain enough confidence to send multifamily starts upward again. An encouraging sign, at least from a developer's viewpoint, is that rents are continuing to move upward.

The total for 1989, then, would

Housing Starts



be 1,325,000 new home starts, down 10.9% from last year's performance. The decline, while never welcome, is far from precipitous. Although the general economy is also a major factor, we believe increases in both fixed and adjustable-rate mortgages over the first half of the year will be the key forces driving down starts this year.

The top 20

A survey of 56 cities by NAHB has produced a list of the top 20 metropolitan housing markets in 1989, a list that keeps changing from year to year.

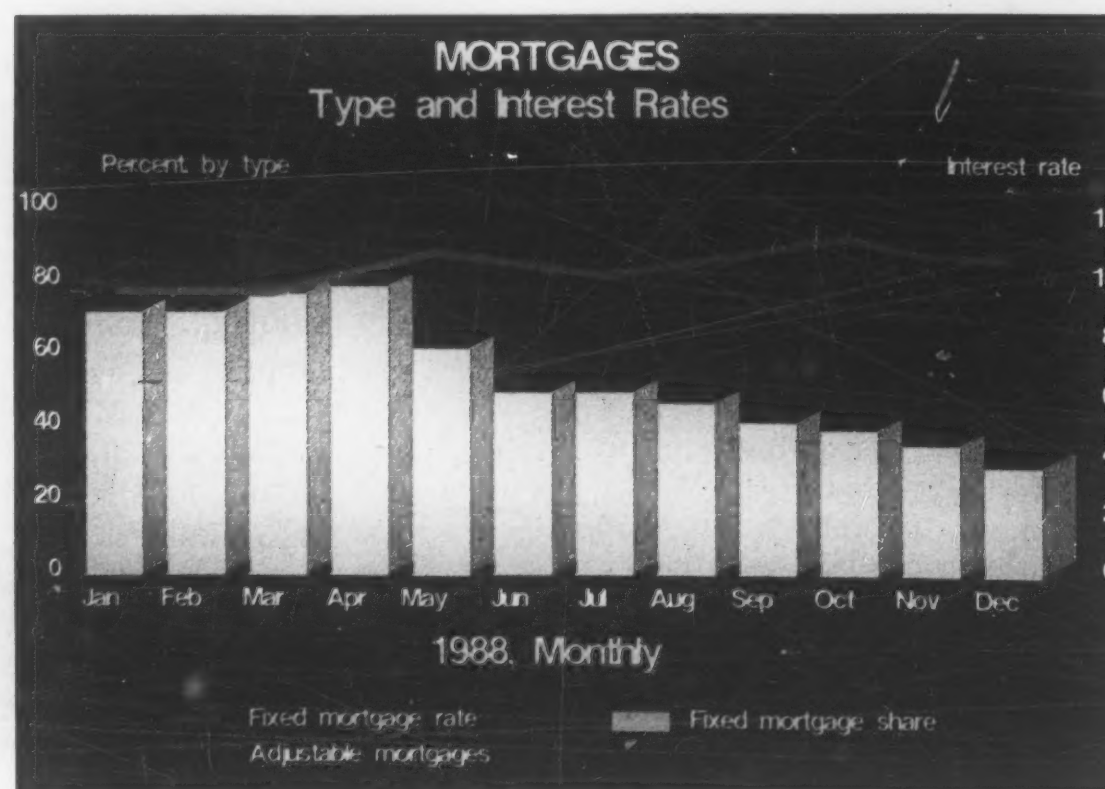
For example, Dallas-Fort Worth led the list as late as 1984, failed to make it in 1988, and was ranked 19th in the current list. And, although Sun Belt cities still are evident, so are those in the Midwest and Northeast.

The top 20, with the number of starts expected this year, follow: Los Angeles, Riverside, Anaheim, 113,000; New York 45,950; Washington, D.C. 37,660; Atlanta 36,900; San Francisco, Oakland, San Jose 36,500; Chicago, Gary, Lake City 31,200; Phoenix 28,000; Seattle, Tacoma 27,100; Orlando 24,500; San Diego 21,600.

Detroit, Ann Arbor 20,000; Las Vegas 19,000; Minneapolis, St. Paul 19,000; Baltimore 16,970; West Palm Beach, Boca Raton, Delray 16,745; Philadelphia 16,671; Fort Lauderdale, Hollywood, Pompano 16,075; Miami, Hialeah 16,045; Dallas, Fort Worth 15,770; and St. Louis 12,246.

Mortgage questions

Mortgage rates play an important role in determining the potential number of new home buyers.



HOUSING AND CONSTRUCTION

ply in recent months and are closing the gap separating ARM's from fixed-rate charges.

This has led to a situation where, in late March, the cost of an ARM averaged 9.02% nationally and a fixed-rate mortgage averaged 10.98%. With less than a 2% difference between the two, why would a potential borrower opt for an ARM with its risk of higher future interest rates?

The explanation, according to mortgage bankers, is that many thrifts have been — and still are — offering discounts of up to 3% below ARM market value in order to attract borrowers.

Secondary mortgage market investors such as the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac) have tightened their rules for ARM acceptance. But, if the thrifts hold these ARM's in their own portfolios — as most do — these rule changes have no effect.

There are no indications of an overall shortage of mortgage money. The secondary market, managed in large part by Fannie Mae and Freddie Mac, has proven to be effective in passing through mortgage originations to the general investment market in attractive forms. However, the impact of the discounted ARM's, especially when the size of the ARM market is considered, causes serious concern.

Remember, too, that half of the mortgages granted homeowners since 1984 have been ARM's. As short-term interest rates rise — driven by the nation's need to attract foreign capital in the face of rising interest rates abroad — the rates for these existing ARM's will escalate in lock-step. It will mean especially stiff jolts for those entering the second year of a discounted ARM.

Taken together, we believe that the financial problems of some thrifts, the public's perception of those now solvent, and the impact of the discounted ARM's could cost the home building industry more starts than we have predicted. In late March, however, the situation was too fluid to estimate the damage.

Multifamily financing also is changing. Since the 1986 Tax Act halved the typical after-tax internal rate of return for tax-motivated investors, life insurance companies and pension funds are increasing their shares. Debt financing has shifted away from tax-exempt bonds and toward insurance companies, banks, and thrifts.

Other concerns

On another front, remortgages to take advantage of lower rates (remember the 16.6% average in 1981?) accounted for about 45% of all mortgages in 1986 (when rates averaged 10.2%). Since that time, they have not been a significant factor. Mortgage delinquencies, at 4.73% in the third quarter of 1988, were a hair above the 4.71% level at the same time a year earlier.

Although specific programs have not been announced, both Fannie Mae and Freddie Mac report they are developing financing to help low- and moderate-income families buy homes. Increased focus on the problems of

the homeless also is expected to spark Department of Housing and Urban Development (HUD) programs.

According to NAHB, the number of new homes sold for more than \$150,000 (in 1987 dollars) has grown faster than the number of families with annual incomes over \$75,000. In 1981, about 15% of homes sold were priced at more than \$120,000 (equal to \$150,000 at 1987 prices).

In 1987, a total of 671,000 homes sold (26%) were priced at more than \$150,000. The increase came partly from an expansion of those crossing the \$75,000 income rate and partly from those trading up as home equity increased.

It should be noted also that, despite high vacancy rates in some

markets, the supply of low-cost rental units continues to shrink as units are lost to abandonment or upgraded to attract higher-income tenants. The burden of higher rental payments as a percentage

of income also has contributed to the rising incidence of homelessness.

Demographics

Low-income households, particularly single parents with children and young couples trying to buy their first home, also are among the biggest losers in today's housing market.

Contrary to the Yuppie myth, people born at the peak of the baby boom are at an economic disadvantage compared to other generations simply because there are so many of them. The home ownership rate among the 24-29 age group fell from 43.3% in 1980 to 35.9% in 1987 and, for the 30-34 age group, the rate fell from 61.1% to 53.2% in the same period.

A 36% increase in the 45-64 age group by the year 2000 will create a demand for smaller, high-quality units for those moving from existing houses, according to McGraw-Hill/LSI Systems. Similarly, a 22% rise in the over-65 age group will create a need for congregate housing and health care facilities.

The study estimates that annual housing demand over the period will average 1.5 million units, that the 35-50 age group will show the most growth, that larger move-up homes will be the mass market of the 1990's, and that the South's decline will reverse and join the West as the two most active housing markets.

A 13% decline in the 25-34 age group after 1990 will mean less de-

(Next Page, Please)

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

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HOUSING AND CONSTRUCTION

(Continued from Preceding Page)

mand for smaller and more affordable homes and family rental units. Too, the 14% drop in the 18-24 age group will mean less demand for rental apartments.

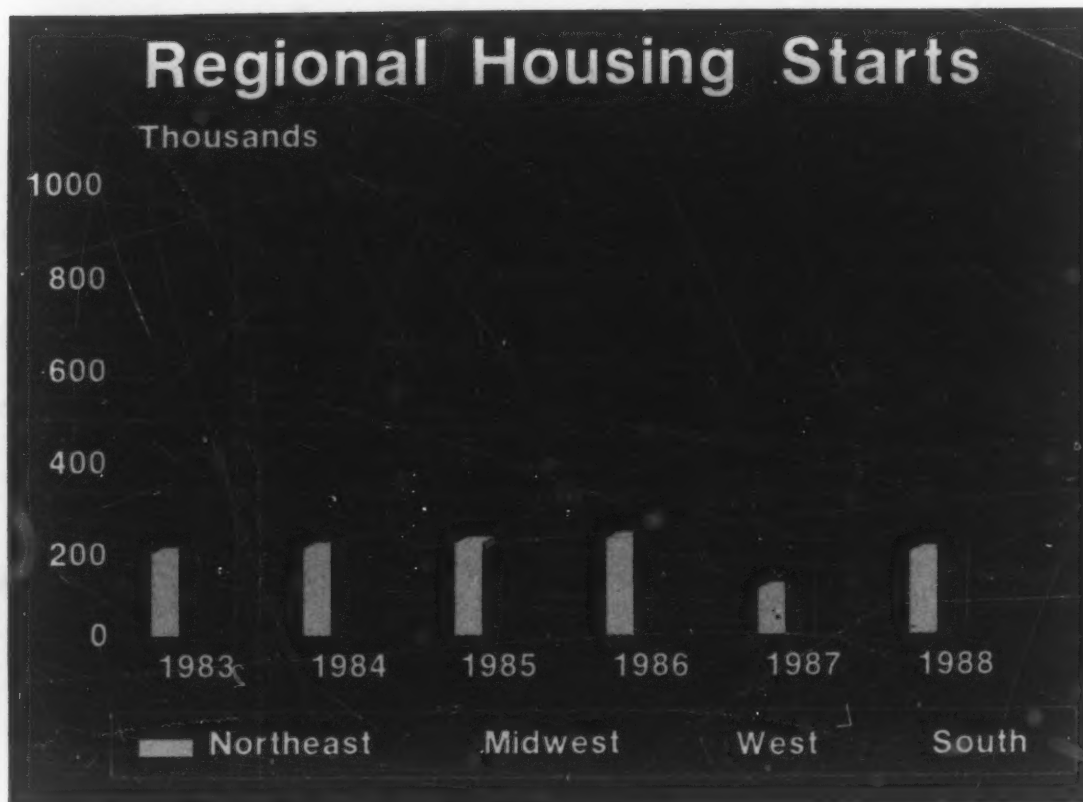
Other sectors

In areas other than the east and west coasts, single-family homes are likely to continue to be the expectation of most home buyers, according to NAHB. Exceptions would be small percentages in major metropolitan areas.

In the Northeast, townhouses (including duplexes and attached row houses) account for a large percentage of single-family starts. In 1987, for example, the region accounted for 17.8% of the nation's single-family starts but 38.7% of townhouse starts.

The concentration suggests high land costs, cultural tradition, and land-use regulations. Most are built as for-sale condominiums. In California, where land costs are as high or higher, the trend is toward "patio homes" built in densities of 10 to the acre.

Of the 346,500 privately owned nonsubsidized apartment units in buildings of five units or more completed in 1987, a total of 14,700 were built in the Northeast; 63,100 in the Midwest; 124,600 in the South; and 144,200 in the West. Of the total, 58% asked



rents of \$500/month or more and 27% asked less than \$400/month.

Also in 1987, a total of 89,500 condominium units were completed, with a median asking price of \$114,600. For the record, there were also 1,400 co-op units, 7,900 furnished apartments, 17,100 federally subsidized units, and 11,500 other multifamily units.

At present, there are between 4 million and 5 million second homes, including about 500,000 mobile homes, according to NAHB. The trade association reports a construction rate of be-

tween 100,000 and 125,000 units per year, up from an annual rate

of 65,000 in 1980.

Ownership of second homes is concentrated among middle-aged married couples. The latest surge springs from the so-called baby boomers who are reaching middle age in increasing numbers.

Mobile homes

Shipments of mobile or manufactured homes in 1988 totaled 218,429 units, a decline of 6.1% from the 232,589 mobile homes shipped in the previous year, according to the Manufactured Housing Institute (MHI).

Shipments of these site-delivered homes, popular with retired people and those with moderate incomes, are not counted in the official housing statistics.

For the past three years, mobile homes have amounted to 20% of private single-family site-built

homes, down from 26% in 1985. They compare to 36% in recession-ridden 1982.

The South Atlantic region, with a 36.4% share, and the South Central region, with an 18.2% share, were the leading mobile home markets again in 1988 even though shipments to these areas were down 9% and 16% respectively. The East North Central region showed a 2.6% increase in shipments last year but was a distant third in market share, at 13.5%.

The number of homes in inventory, 523 at the end of 1988, was 24% less than the 688 homes in inventory in December, 1987.

Of the total, 56% were single-section units last year and 44% were multisection units. The product mix was 59.8% single- and 40.2% multisection homes in 1987.

REPLACEMENT MARKET

From an industry perspective, replacements represent the glue that holds individual markets together when new construction markets sag. And for contractors, they provide a stabilizing force that permits their emphasis to swing in time with local economic conditions.

The surge in replacements of worn-out units has been coupled over the past three years with growth in modernization (add-ons) and replacements to obtain higher efficiencies. Together, they have kept residential comfort heating-cooling equipment sales at or near record levels despite significant declines in new home starts in the last two of those years.

Although substantial replace-

ment sales have been a fact of life for home heating equipment for many years, it is a relatively recent phenomenon for the younger central air conditioning and heat pump markets. Recognition of this fact has sparked new market approaches by both manufacturers and contractors.

Because service is a prime route to replacement sales, contractors who once regarded service as a necessary nuisance now are putting increasing emphasis on this business segment. More aggressive contractors are developing marketing plans to uncover additional potential customers who would be interested in upgrading equipment for efficiency reasons.

Several manufacturers have re-

vised their marketing stance to both condition homeowners about potential energy bill savings and to get close to contractors who are exploiting the replacement and add-on markets.

One is offering contract-free marketing assistance if they will work with the manufacturer in developing this new potential. A few are buying wholesale outlets to get broader distribution in key markets. One that formerly only sold to contractors has, through acquisition, set up another company to sell through distributors as well.

In addition to a sustained high level of consumer awareness about the wisdom of upgrading equipment efficiencies, many electric utilities continue to offer rebates for those who meet specific minimums. Even though gas utilities seldom offer such incentives, the one third of gas furnaces and two thirds of oil furnaces shipped last year that were in the high efficiency bracket leaves little doubt about consumer awareness.

The percentage of replacements within shipment totals varies widely among product groups. Last year, for example, it ranged from less than 10% for electric furnaces to 79.3% of all oil furnaces shipped.

The central air conditioning market, which once depended heavily on new home starts, now depends on replacements for more than half of its volume. And more than a third of residential heat pump shipments last year were replacement units.

A macro view

Before examining individual industry markets, it's significant that national expenditures for residential alterations and repairs, in current dollars, have grown from \$45.2 billion in 1982 to \$94.082 billion in 1987 — an increase of 108%.

These latest figures are based on surveys of 51.3 million owner-occupied homes and 14.7 million rental units conducted by the Bu-

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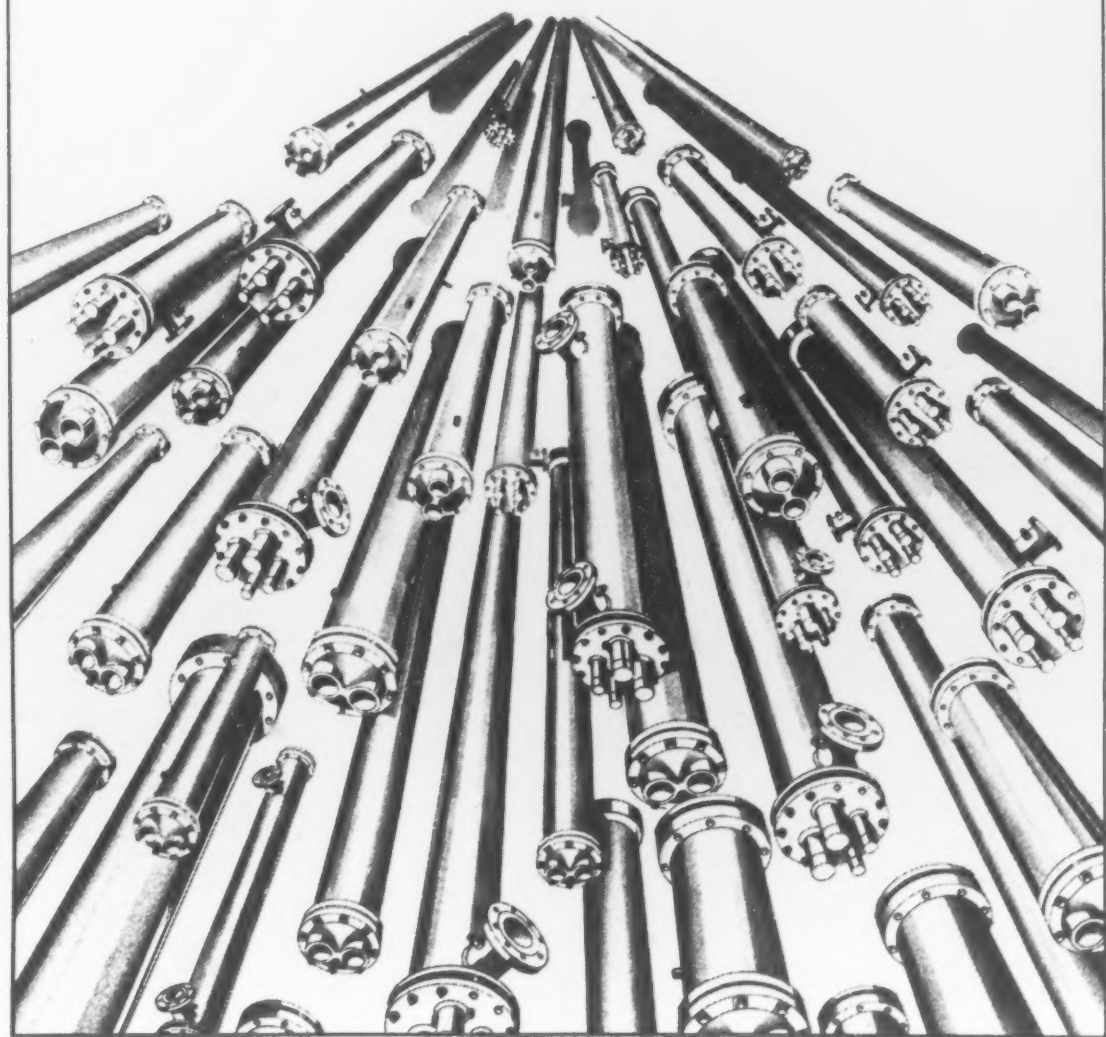
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Circle 23

REPLACEMENT MARKET

reau of the Census and the Bureau of Labor Statistics.

The 1987 total is 3% greater than the \$91.274 billion recorded in 1986. The National Association of Home Builders (NAHB) expects the 1988 total to top \$100 billion, but forecasts that annual increases for the next three to five years will be in the 4% to 6% range.

Heating and air conditioning alterations and repairs, at \$6.410 billion in 1987, accounted for 6.8% of total expenditures. It also represented a 2.8% increase over the 1986 total of \$6.232 billion.

Of the 1987 heating and air conditioning total, maintenance and repairs accounted for \$2.340 billion, or 36.5%; additions and alterations accounted for \$1.534 billion, or 23.9%; and major replacements accounted for \$2.537 billion, or 39.6%. Also, \$4.206 billion (or 65.6% of the total) was spent in owner-occupied dwellings, while \$2.204 billion (34.4%) was spent in rental units.

Major replacements include furnaces, boilers, central air conditioners, and heat pumps. Regionally, total expenditures for the heating and air conditioning segment in 1987 broke down this way: Northeast 26.3%; Midwest 28.4%; South 38%; and West 7.3%.

Contractors are tops

Contractors are doing almost all of the heating and air conditioning work. In 1987, contractors did 94.8% of all jobs and, in only 1% of those jobs did the homeowner purchase equipment or materials. Of the major replacements, contractors did 97.5% of the jobs in 1987 — up from 91% in 1984.

Of the \$54.8 billion spent on remodeling single-family homes in 1987, homes built before 1960 accounted for \$21.9 billion. Of that, 62.4% was spent on homes in the Northeast and Midwest. Of the newer homes built between 1980 and 1987, the South and West accounted for 68.5% of the expenditures.

There are many reasons for the surge in home renovations, which accelerated in the years 1983 through 1986. The most obvious is that the nation's 100 million-plus housing stock keeps aging. Affordability problems, particularly in the Northeast and parts of the West, are forcing many to buy existing rather than new homes. With the purchase comes an urge to add missing amenities.

A study conducted by the Joint Center of Housing Studies at Harvard-MIT has shown that more than 50% of renovation expenditure takes place within five years of purchase. Existing home sales have been on a high plateau — averaging 3.5 million units — for the past three years.

The Harvard-MIT study also noted that 40% of home sellers spent an average of \$1,265 to fix up their homes prior to selling them. Most of that expenditure, however, was thought to be for repairs rather than for improvements or major replacements.

Air conditioning

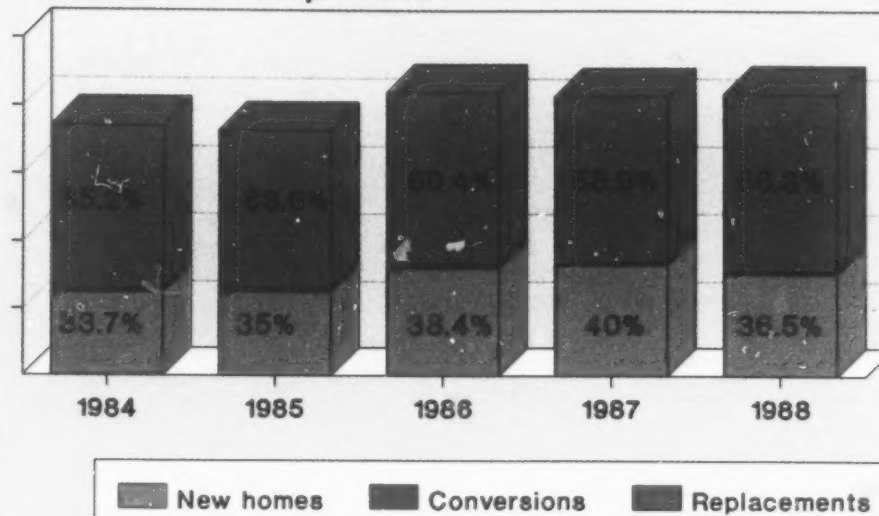
For easier understanding and better accuracy, the replacement market for unitary air conditioning should be separated into four parts — residential and commercial comfort cooling and residen-

(Page 48, Please)

GAS FURNACES

New homes, replacements

Percent of shipments



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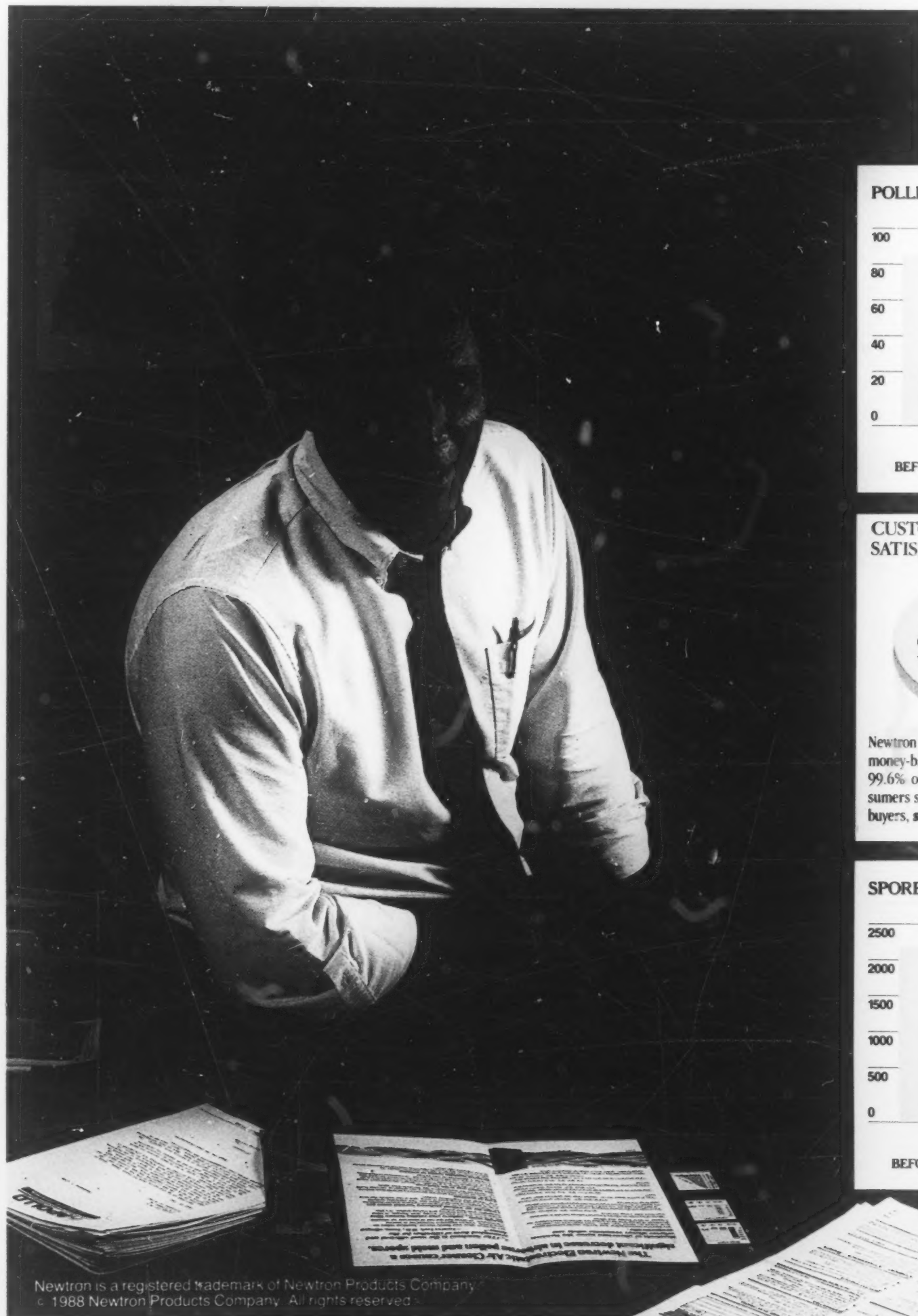
Newtron eliminates all the headaches of air cleaner sales. Powerpack failures and noise complaints caused by arcing "come with the territory" whenever electronic air cleaners are sold. On the other hand, the Newtron air cleaner, because it is totally passive, has no powerpacks, is totally noise-free and does not produce profit-eating call-backs. Newtron air cleaners are covered by a five-year warranty and 30-day money-back guarantee.

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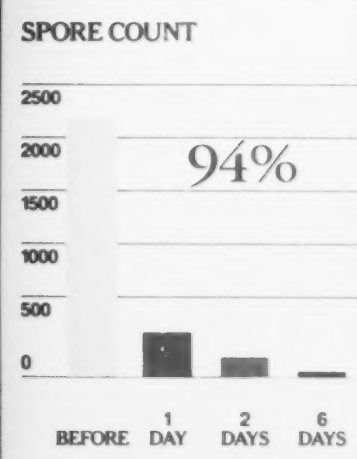
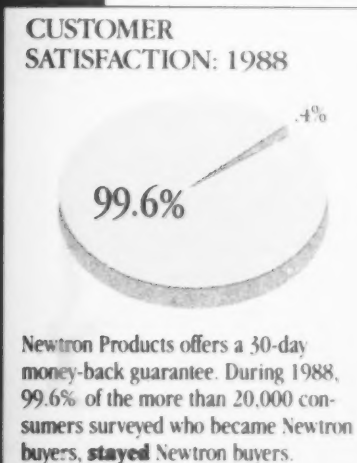
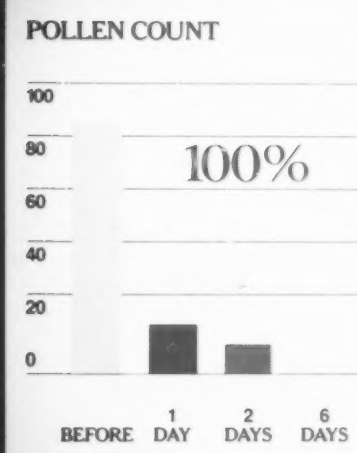


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REPLACEMENT MARKET

(Continued from Page 45)

tial and commercial heat pumps.

If we subtract 834,606 heat pumps from the 1988 unitary total of 4,049,212 units, we get 3,214,606 comfort cooling units — of which 82.4% or 2,648,800 were residential and 17.6% or 565,800 were commercial units.

This split was selected because it matched the latest determination of the Air-Conditioning and Refrigeration Institute (ARI). (If you're comparing this split with the one found in the *Air conditioning* segment, remember that this one does not include heat pumps.)

Of the 2,648,800 residential cooling units shipped in 1988, we estimate that 791,700 (29.9%) went into new construction (551,200

into single-family homes and 240,500 into multifamily units). These figures are arrived at by multiplying the known penetration rates for central air conditioning (less heat pump penetration) with the known number of housing starts.

The new single-family air conditioning and heat pump totals were increased by 16% last year and in 1987 to reflect the extra units going into larger homes to accomplish zoning. Another distortion in 1988 was the 50,000 air conditioners taken from field inventories because of the unseasonably

hot weather in much of the country.

Looking back at the air conditioners used in new site-built homes last year, we find an 8.5% decline from the 864,800-unit total for 1987. The drop in 1987 from the 1986 peak was nearly 6%. Similarly, units used in mobile homes, at 78,100 last year, were down 8.8% from 85,600 units in 1987.

Replacement air conditioners in 1988 represented 53% of the central residential cooling market, up from 48% a year earlier. There has been a steady upward progression

from 36% in 1984. If our projections hold true, the replacement percentage should reach 56.6% this year.

In terms of numbers, we estimate that 1,405,200 units were replacement central air conditioners in 1988, up 17% from the 1,201,500 replacements in the previous year. We expect little, if any, growth in replacement shipments this year.

Add-on or modernization units for homes not previously cooled with a central system, enjoyed the lion's share of the market in the 1960's and early 1970's. The percentage shrank to about 12% early in this decade. But two hot summers in a row, plus utility efficiency incentives, have increased the add-on share to 14% in 1987 and 16% last year. Higher interest rates, however, should reduce that share to 12% this year.

In terms of numbers, we estimate that 423,800 units were add-ons in 1988, up 21% from the 350,300 add-on units shipped in the previous year. The total probably will decline by 29.8% in 1989 to 297,500 units.

It must be remembered that central air conditioners already have been installed in more than 30

million U.S. homes. Of these, more than a million each year cross the 12- to 15-year-old prime replacement category. When major service problems arise, many contractors urge replacement of eight-year-old or younger units for reasons of efficiency.

Commercial

Of the estimated 565,800 commercial unitary comfort cooling units shipped last year (up 5.9% from 534,400 units in 1987), we think the total was evenly split between new construction and replacement units.

As late as 1985, we estimated that 70% of commercial unitary products went into new construction. Industry sources indicate that the replacement segment has been growing steadily. We agree, even though there are no firm benchmarks.

Heat pumps

Of the 834,606 air-to-air heat pumps shipped last year, we estimate that 709,400 (17.6%) were residential units. Of these, 448,400 units (63.2%) went into new site-built homes (338,300 units in single-family and 110,100 units in multifamily homes), and 28,900 units were installed in mobile homes.

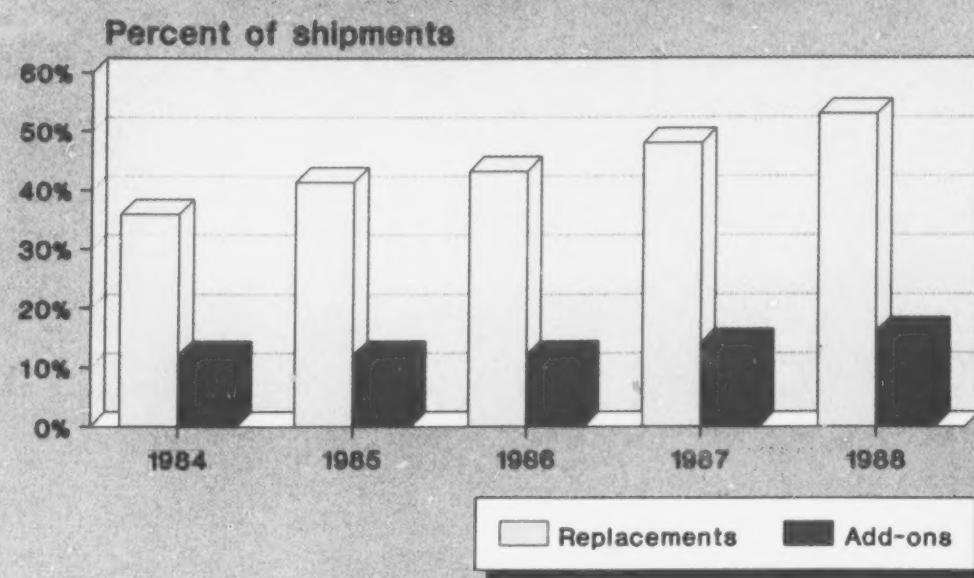
Heat pump replacement and add-on units, at 256,100 units in 1988, represented 36.9% of the residential market — up from 36.1% in 1987 and 16.7% in 1985. The 24,000 units taken from field inventories because of last summer's hot weather have been added into this category.

The decline of the housing market in the South, the prime market for heat pumps, has been costly. This, together with national home-building declines in each of the past two years, has added to the problem.

Contractors, particularly in the South, have been concentrating on replacement sales when new construction has been slow. This was enough in 1987, when the replacement and add-on market increased by 29.9% to 262,100 units, and in 1988. This year, however, we expect a 2.4% slip to 250,000 units and a contribution, however slight, to this year's heat pump slippage.

The replacement drive has been helped by the sharp increase in heat pump efficiencies. In fact, the 1988 average for heat pumps edged higher than central cooling units for the first time. Another factor is the small but growing

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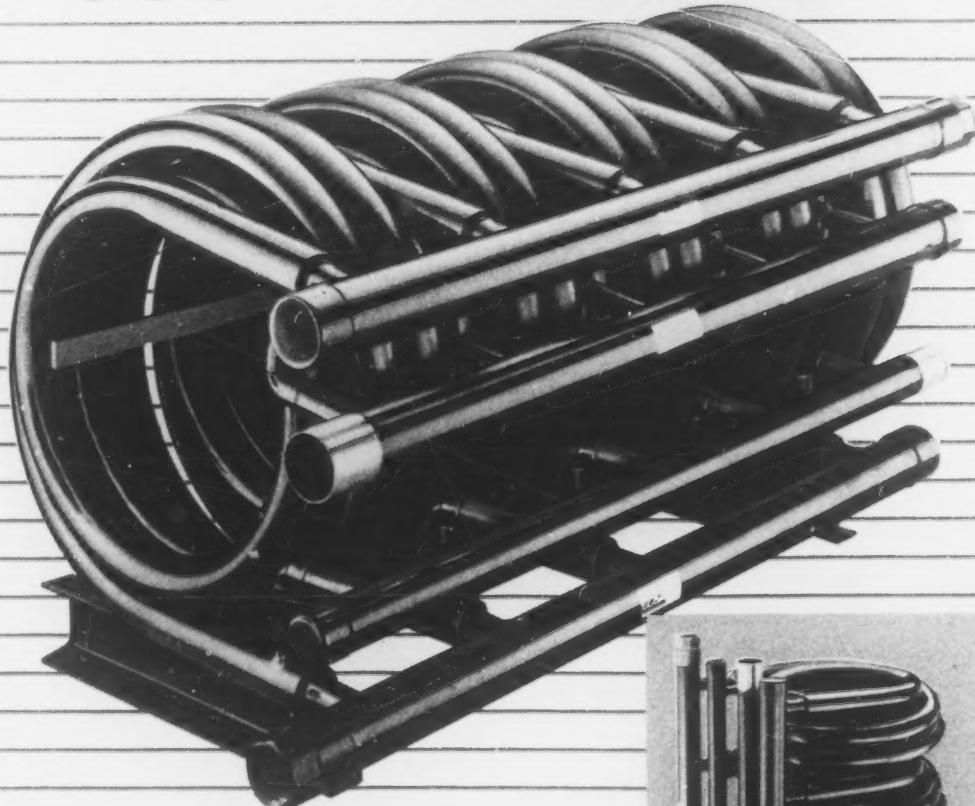
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REPLACEMENT MARKET

trend among some contractors to replace a split-system air conditioner with a heat pump, especially if utility rebates help defray the cost premium.

Furnaces

Of the 2,092,165 residential gas furnaces shipped in 1988, we estimate that 763,200 (36.5%) went into new single- and multifamily houses, 20,000 were conversions from other fuels, and 1,308,965 furnaces (62.6%) were replacement units.

This represents a 7.2% increase over the 1,221,525 replacement gas furnaces shipped in 1987. It was the main contributor to the small increase in overall gas furnace shipments last year. What's more, replacements should keep total gas furnace shipments even in 1989 despite a drop in housing starts.

In addition to the replacements among the more than 10 million gas furnaces at least 15 years old, a new efficiency market has grown up in recent years. More and more homeowners are replacing furnaces in good working order so they can take advantage of the substantial improvements in efficiencies available in recent years.

In 1988, for example, more than a third of all furnaces shipped had AFUE's (annual fuel utilization efficiencies) of more than 80%. The atmospheric furnace with a standing pilot, the mainstay for many years, will be all but eliminated by federal minimums in 1992.

Of the 203,785 residential oil furnaces shipped last year, we estimate that 25,600 (12.6%) went into new single- and multifamily homes and 16,500 were conversions from other fuels. This means that 161,685 oil furnaces, or 79.3% of the total, were replacements.

The performance of oil furnace replacements last year represented a 2.4% improvement over the 157,945 replacement units shipped in 1987. We expect this category to slip by only 1.3% in 1989 to 159,600 units.

Although the share is not large, the penetration of oil furnaces in new homes — particularly in the Northeast — increased in the period 1984 through 1987. That increased market share has held up in 1988.

Not to be forgotten, either, should be the 218,000 replacement oil burners shipped in 1988. Nearly all of these, as well as the new furnaces, were equipped with retention-head or other high-efficiency burners.

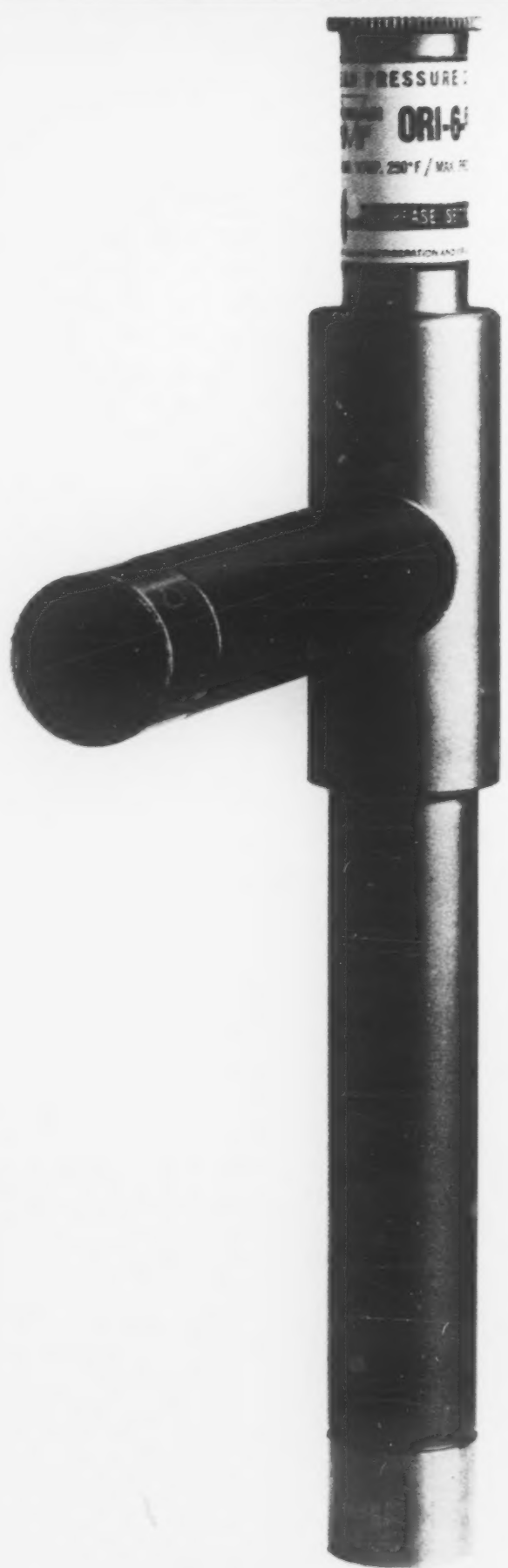
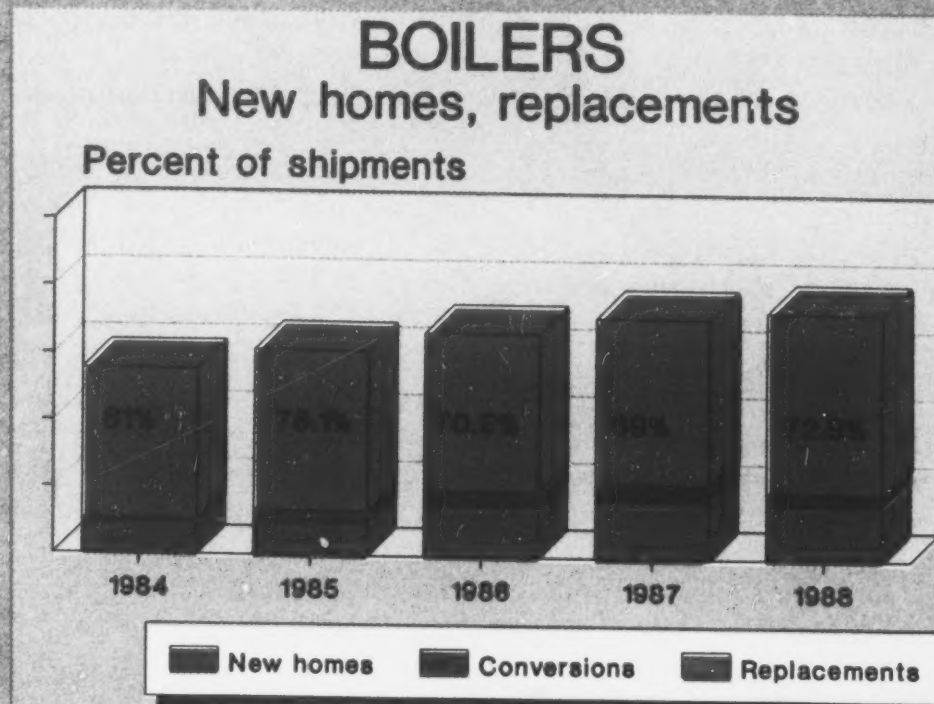
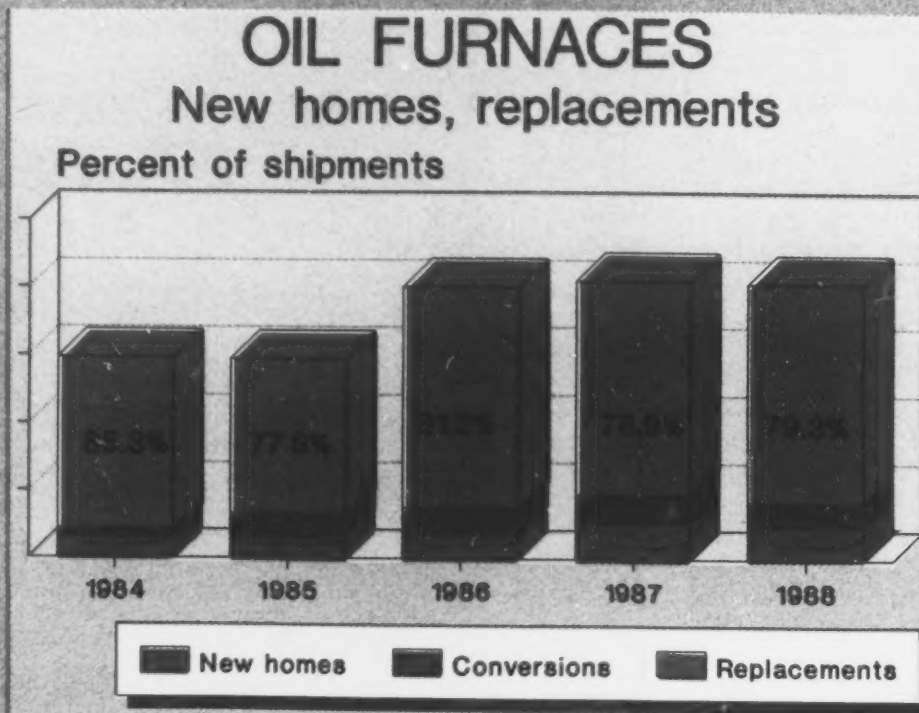
Boilers

Of the 367,440 residential boilers shipped last year, we estimate that only 82,500 (22.6%) went into new single- and multifamily homes and 16,500 were conversions from other fuels.

The other 268,040 units, or 72.9%, were replacements. This represents an 8.8% gain over the 246,366 boiler replacements shipped in 1987.

The ratio of replacements to new construction has favored replacements by more than four to one as late as 1984. Since that time, however, increased market penetration in the Northeast has enlarged the new construction share.

USE THE CLASSIFIED MARKETPLACE



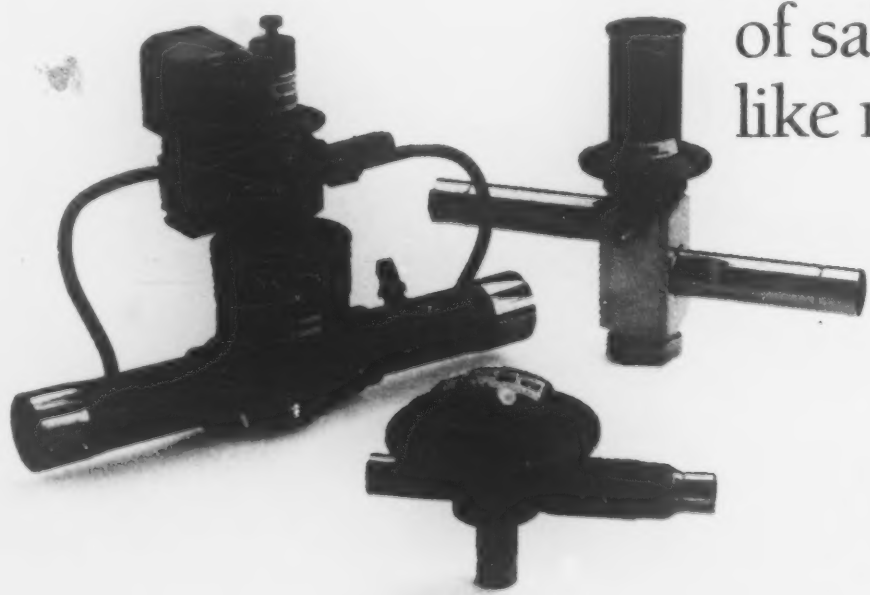
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Exports of air conditioning and refrigeration equipment rebounded sharply last year to top the \$2.073-billion peak of 1981. And although the positive trade balance nearly doubled, the growing U.S. appetite for compressors, room units, and mini-splits in 1988 kept that total to only one-third of the \$1.8-billion trade surplus of seven years earlier.

More than half of the imports through the first 11 months of last year were in three categories — \$553.9 million worth of compressors, \$215.8 million worth of room air conditioners, and \$59.7 million worth of mini-split (ductless) air conditioners and heat pumps.

The U.S. registered export gains across the board. In the case of imports, the 11.7 million compressors imported through the first 11

months of 1988 — about half the number manufactured in the U.S. — represented a slight increase over the 11.5 million compressors imported in all of 1987.

Room air conditioner imports, however, increased by 37% to 956,127 units for the first 11 months of 1988 over the full-year 1987 total of 697,446 units. Room unit imports, which totaled only 98,000 in 1983, have demonstrated steep increases in every year since. Last year, imports amounted to almost one-quarter of U.S. production.

Although not designated as such, it would appear that the market for imported mini-splits, or ductless air conditioners and heat pumps, now is approaching 300,000 units annually, or more than 7% of the U.S. unitary mar-

ket last year.

Import statistics for the first 11 months of 1988 indicate that 187,625 air conditioning condensing units were imported from Japan, along with 13,925 heat pumps of less than 5-ton capacity, 135 heat pumps of more than 5 tons, 2,933 other heat pumps, and 21,491 evaporator coils. In addition, the U.S. imported 79,121 heat pumps of less than 5 tons from Singapore in the same period.

During the previous full year, the U.S. imported 203,337 air conditioning condensing units from Japan, along with 8,075 heat pumps of less than 5 tons, 5,619 other heat pumps, and 21,871 evaporator coils. Also in 1987, the U.S. imported 21,351 heat pumps of less than 5 tons from Singapore.

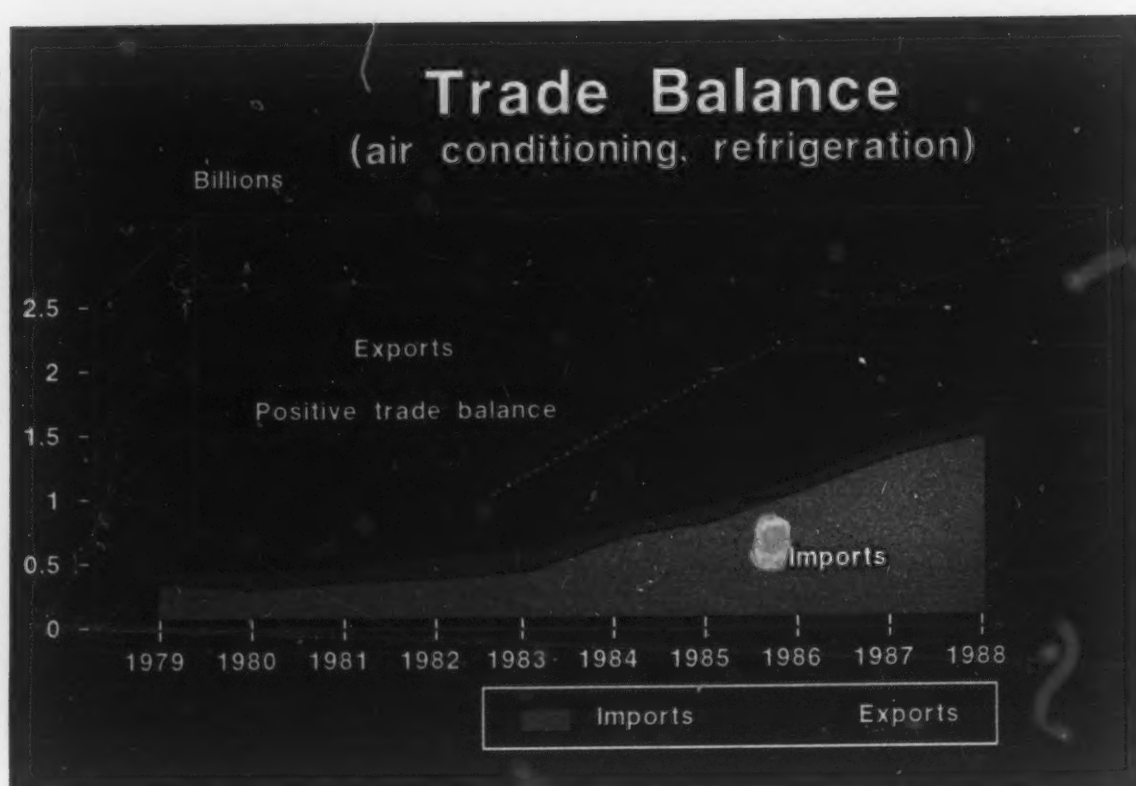
There are many reasons for the continued increases in imported equipment and components. In addition to the foreign companies seeking to initiate or expand U.S. market opportunities, two U.S. compressor manufacturers and a pair of room unit manufacturers have moved all or part of their production offshore so they can better compete in world markets.

The past two unusually hot summers also have sparked high demand for room units, and the rotary compressors used in most of them, from whatever source.

The decline of the dollar against the yen over the past two-and-a-half years is having an effect on Japanese manufacturers. Japan accounted for 49% of U.S. air conditioning and refrigeration imports in 1987 but, through the first 11 months of 1988, it was 42%.

For U.S. manufacturers, the decline of the dollar against the yen and other major world currencies, has had an obviously positive effect, especially in those countries that tie their own currencies to the dollar.

However, the Japanese have made no secret of the fact that they are sourcing less expensive components in the world market



and building plants in such places as Singapore (with nearly a 10% share of U.S. imports last year) in order to hang on to U.S. and world market shares.

It should be noted also that, in 1988, Canada and the U.S. ratified a free trade agreement that will remove tariffs on air conditioning, refrigeration, and heating equipment and components over the next ten years. Canada continues to be the best customer for U.S. exports, even though its share keeps shrinking as other exports grow.

Although we were able to obtain 1988 full-year totals for both imports and exports, a detailed breakdown of those totals was not available from the Department of Commerce. We did, however, obtain a detailed breakdown for the first 11 months of last year. Heating equipment import and export figures also were not available.

The reason for the delays in reporting this year is a changeover to the international Harmonized System (HS) at the start of 1989. Previously, the Commerce Department has used the Tariff Schedule of the U.S. Annotated (TSUSA) for imports, and Schedule B of the Bureau of the Census for exports.

The new classification system is expected to bring the data more in line with SIC (Standard Industrial Code) 3585, Air Conditioning and Refrigeration Equipment, Including Warm Air Furnaces. This is the report used by *The News* for our 10-year look at shipments elsewhere in this issue.

Trade balance

The total value of U.S. air conditioning and refrigeration exports in 1988 was \$2,093,170,000 in 1988, an increase of 29.6% over the previous year's total of \$1,615,436,000, according to the Department of Commerce. In 1981, U.S. exports totaled \$2.073 billion.

At the same time, the \$1,476,866,000 worth of air conditioning and refrigeration equipment imported into the U.S. last year represented an increase of 14.3% over the 1987 total of \$1,292,395,911. In 1981, imports totaled \$273.8 million.

Imports represented 71% of exports last year, down from 80% in 1987. In 1981, imports represented only 13.2% of exports.

The positive balance of trade generated by air conditioning and refrigeration equipment was \$616,304,000 in 1988, an increase of 90.8% over the all-time low of \$323,040,000 recorded in 1987. The positive trade balance in 1981 was \$1.8 billion.

It must be remembered that these figures only represent shipments. They do not take into account the profits of U.S. companies from subsidiaries, joint ventures, and licensing agreements that are not reinvested abroad.

In 1988, the sixth year in a row, Canada was the leading export market for U.S. air conditioning and refrigeration products. The \$578 million worth of exports to Canada, or 28% of total exports, represented a 3.9% increase in the value of shipments (from \$556.1 million in 1987) but a drop in export market share from 34% a year earlier. U.S. imports from Canada last year totaled \$72.6 million, down 3% from the prior-year total.

The Middle East, which had been the leading export market for many years, accounted for only 12% of the total last year, or \$251.4 million. That market increased by \$77.7 million and an 11% world market share in 1987.

The Western Europe export market increased by \$114 million in 1988 to \$401 million, and its

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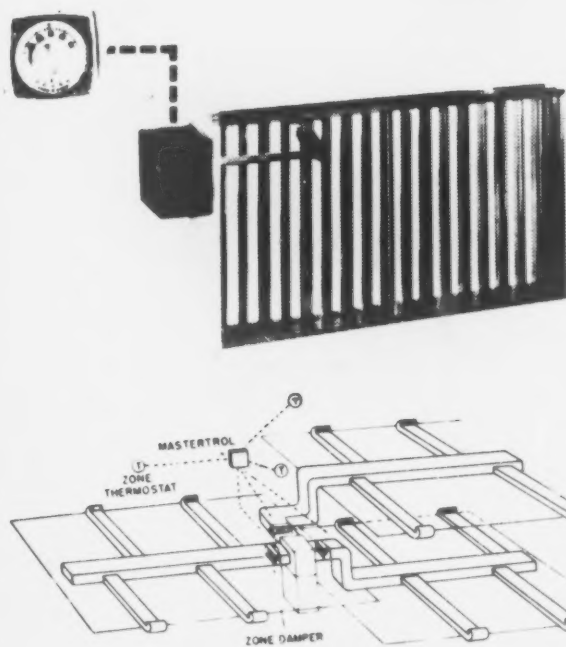
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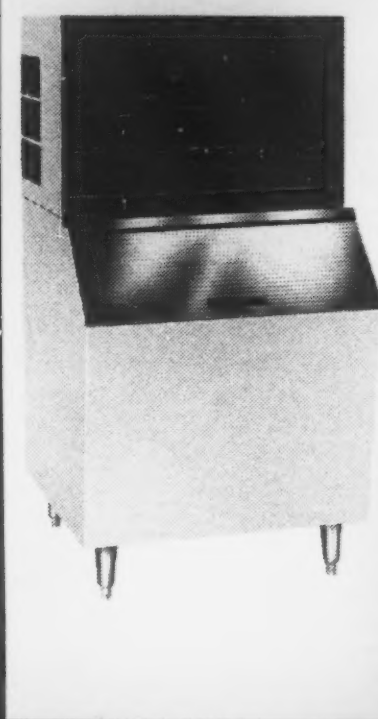
Installed in the air supply ducts to each zone, Trol-A-Temp Dampers automatically control the flow of conditioned air to only those rooms or zones where heating (or cooling) is called for by the corresponding Zone Thermostat. When the thermostat in any zone calls for heating (or cooling), the corresponding zone damper remains open while all other dampers move to the closed position. This directs the full flow of conditioned air into only the zone that's calling, and does not waste fuel or energy overheating or overcooling zones that are already satisfied. The Mastertrol Panel turns the burner (or compressor) on until the zone is satisfied. When all zone thermostats are satisfied, the burner (or compressor) shuts off, and all zone dampers return to the open position to allow continuous air circulation to be maintained if desired.

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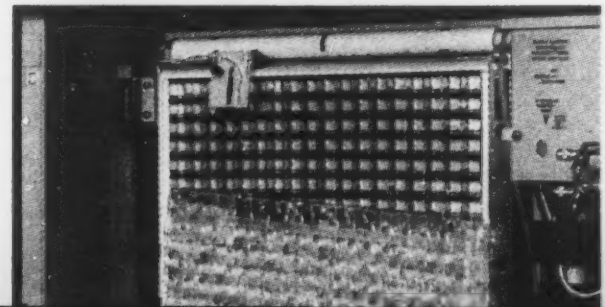
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Circle 32

INTERNATIONAL

world market share increased from 18% to the same 19% share recorded in 1987. Although its world market share slipped from 16% in 1987 to 14% last year, the Central and South American market increased by \$36 million to \$303 million in 1988.

The Far East, with an increase of \$210 million in the value of shipments to \$507 million last year, also increased its world market share from 18% in 1987 to 24% last year. Exports to African nations increased from \$37 million to \$51 million in 1988 but its world market share remained constant at 2%.

Imports

According to the Department of Commerce, eight nations accounted for 89% of the \$1.477 billion worth of air conditioning and refrigeration equipment and components imported into the U.S. in 1988. Figures for the eight countries follow. The dollar amount represents the full year, while the shipment breakdowns represent total shipments for the first 11 months.

- **\$622.4 million from Japan**, down 0.5% from \$634.2 million in 1987, which mostly included 1,020,449 compressors of less than 0.25 hp, 1,323 screw compressors, 3,372,521 automotive compressors, 874,629 compressors of from 0.25 to 1 hp, 350,716 compressors of from 1 to 3 hp, 3,134 compressors over 3 hp, 44,176 room units, \$158.6 million worth of automotive air conditioning parts, 16,993 heat pumps, 187,625 air conditioning condensing units, 21,494 evaporator coils, 279,411 refrigerators and freezers, and 3,670 other freezers.

- **\$155 million from Singapore**, up 132% from \$66.6 million in 1987, which mostly included 1,217,476 compressors of less than 0.25 hp, 617,581 compressors of from 0.25 to 1 hp, 37,715 compressors of 1 to 3 hp, 244,843 room air conditioners, 79,121 heat pumps under 5 tons, and 966 evaporator coils.

- **\$126.5 million from Brazil**, up 33.5% from \$95.7 million in 1987, which mostly included 1,534,095 compressors of less than 0.25 hp, 784,399 compressors of from 0.25 to 1 hp, 23,396 compressors of from 1 to 3 hp, 3,531 other compressors, 225,292 room units, 1,594 condensing units, 16,516 refrigerators and freezers, and 7,006 other freezers.

- **\$113.4 million from South Korea**, up 146% from \$46.1 million in 1987, which mostly included 1,880 compressors of less than 0.25 hp, 67,406 automotive air conditioning compressors, 43,899 compressors of 0.25 to 1 hp, 244,694 room units, 110 condensing units, 1,836 evaporators, 90,854 dehumidifiers, 197,118 "other" air conditioners, 10,471 refrigerators and freezers, 24,735 absorption refrigerators, and 1,435 other freezers.

- **\$112.6 million from Mexico**, up 12.2% from \$109.9 million in 1987, which mostly included 9,356 compressors of less than 0.25 hp, 45,987 automotive air conditioning compressors, 8,038 compressors of from 0.25 to 1 hp, 12,148 room units, \$7 million worth of heat pump parts, 349,405 evaporator coils, and \$10.9 million

(Next Page, Please)

Major export markets

U.S. air conditioning, refrigeration equipment (values in millions)

Market	— 1984 —		— 1985 —		— 1986 —		— 1987 —		— 1988 —	
	Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Canada	530	33	534	38	459	34	556	34	578	28
Central, South America	211	13	193	14	234	18	264	16	303	14
Western Europe	290	18	236	16	251	19	287	18	401	19
Far East	247	15	225	16	217	16	297	18	507	24
Middle East	266	17	175	12	140	11	174	11	251	12
Africa	48	3	41	3	28	2	37	2	51	2
Other	11	1	10	1	2	0	0	1	2	1
Total	1,603	100	1,414	100	1,331	100	1,615	100	2,093	100

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INTERNATIONAL

(Continued from Preceding Page)

worth of air conditioner parts.

• **\$72.6 million from Canada**, down 3% from \$75.4 million in 1987, which mostly included 3,778 compressors of less than 0.25 hp, 27,832 room units, \$603,000 in heat pump parts, 1,639 condensing units, 9,659 evaporator coils, 100,672 dehumidifiers, 9,964 "other" air conditioners, \$8.6 million in air conditioner parts, 21,875 absorption refrigerators, 72,497 chest freezers, 12,908 other freezers, and 502 refrigerated display cases.

• **\$56.8 million from Sweden**, up 23.5% from \$46.5 million in 1987, which mostly included 602 compressors of less than 0.25 hp, 1,380 compressors of from 0.25 to 1 hp, and 108,621 absorption

refrigerators.

• **\$56.3 million from Italy**, down 21% from \$72.2 million in 1987, which mostly included 594,445 compressors of less than 0.25 hp, 325,743 compressors of from 0.25 to 1 hp, 342,934 compressors of from 1 to 3 hp, 2,539 room units, 2,571 condensing units, 1,410 refrigerators and freezers, 9,623 chest freezers, and 1,217 refrigerated display cases.

While they didn't make the top eight, other nations had significant import totals in specific categories. West Germany's total, at \$34.4 million, included 38,323 compressors of less than 0.25 hp, 364,299 compressors of from 0.25 to 1 hp, 2,150 condensing units, and 13,183 absorption refrigerators.

Absorption refrigerators also

came from Romania (3,468), Yugoslavia (31,214), and Britain (15,809). Yugoslavia also supplied 13,541 chest and 6,191 other freezers. Denmark supplied 2,706 refrigerated display cases and Costa Rica supplied another 305. Turkey supplied 4,477 refrigerators and the Netherlands supplied 2,085 condensing units. Israel supplied 10,265 room units.

Exports

In terms of products exported from the U.S., the Department of Commerce prepares a country-by-country breakdown for most of the product categories contained in the SIC 3585 classification. Although we do not have space to list the complete breakdowns, a feel for the top export markets of 1988 can be gained by looking for key products and top customer countries.

Because full-year 1988 figures were not available, we have followed the 11-month total for 1988 with the full-year total for 1987.

Auto and truck refrigeration and air conditioning compressors — 256,547 units (215,379 units in 1987): Mexico 79,014; Canada 40,730; West Germany 19,105; Singapore 16,497; Spain 15,713; and Hong Kong 14,254.

Compressors of 3 hp or less — 1,346,003 (823,243 in 1987): Saudi Arabia 305,095; Canada 223,370; Brazil 102,275; Mexico 79,475; Japan 76,188; Venezuela 58,812; Israel 57,266; and Singapore 27,690.

Compressors from 3 hp to 10 hp — 207,230 units (142,494 in 1987): Mexico 36,725; Saudi Arabia 29,315; Thailand 24,054; Venezuela 21,395; Canada 11,485; and Kuwait 11,289.

Compressors over 10 hp — 30,346 units (42,392 in 1987): Venezuela 3,189; France 2,749; Canada 2,497; Britain 2,260; Australia 2,177; and Saudi Arabia 2,084.

Ammonia compressors — 1,959 units (1,887 in 1987): Korea 614; Mexico 341; Canada 152; South Africa 127; Dominican

Republic 117; and Venezuela 116.

Parts for refrigeration and air conditioning compressors — \$48 million (\$45.7 million in 1987): Belgium \$7.6 million; Canada \$4.9 million; South Korea \$4.2 million; France \$3 million; Japan \$2.5 million; and Australia \$1.7 million.

Room air conditioners under 10,000 Btuh — 48,439 units (19,560 in 1987): Taiwan 8,821; Canada 7,512; Mexico 7,138; Hong Kong 3,921; Spain 1,416; and Senegal 1,268.

Room air conditioners from 10,000 Btuh to 17,000 Btuh — 76,713 units (57,785 in 1987): Taiwan 27,153; Hong Kong 19,914; Mexico 3,411; United Arab Emirates 2,989; Canada 1,770; Spain 1,586; China 1,340; and Pakistan 1,235.

Room air conditioners over 17,000 Btuh — 91,818 units (34,660 in 1987): United Arab Emirates 17,720; Hong Kong 11,103; Canada 5,622; Kuwait 5,321; West Germany 4,972; Saudi Arabia 3,149; and Mexico 2,431.

Self-contained heat pumps of 5 tons and under — 22,372 units

(14,918 in 1987): Canada 15,380; Philippines 1,427; Mexico 1,173; Britain 573; France 581; and Australia 523.

Self-contained heat pumps of more than 5 tons — 2,566 units (2,731 in 1987): Canada 867; France 426; Britain 283; China 273; and Australia 264.

Split-system heat pumps — 27,525 units (14,632 in 1987): Canada 12,819; Taiwan 3,418; France 2,375; Spain 1,064; Pakistan 960; and Qatar 930.

All-year heating-cooling packages 5 tons and under — 31,000 units (25,316 in 1987): Canada 22,244; Mexico 2,704; Taiwan 998; and Bahamas 853.

All-year heating-cooling packages over 5 tons — 11,132 units (9,411 in 1987): Canada 8,294; Mexico 990; Britain 422; and Australia 284.

Self-contained air conditioners 5 tons and under — 40,897 units (22,843 in 1987): Canada 14,875; Taiwan 6,906; South Africa 1,751; Mexico 1,270; West Germany 1,248; and China 1,117.

Self-contained air conditioners over 5 tons — 11,377 units (11,627 in 1987): Canada 4,552; France 1,087; Britain 532; and Mexico 474.

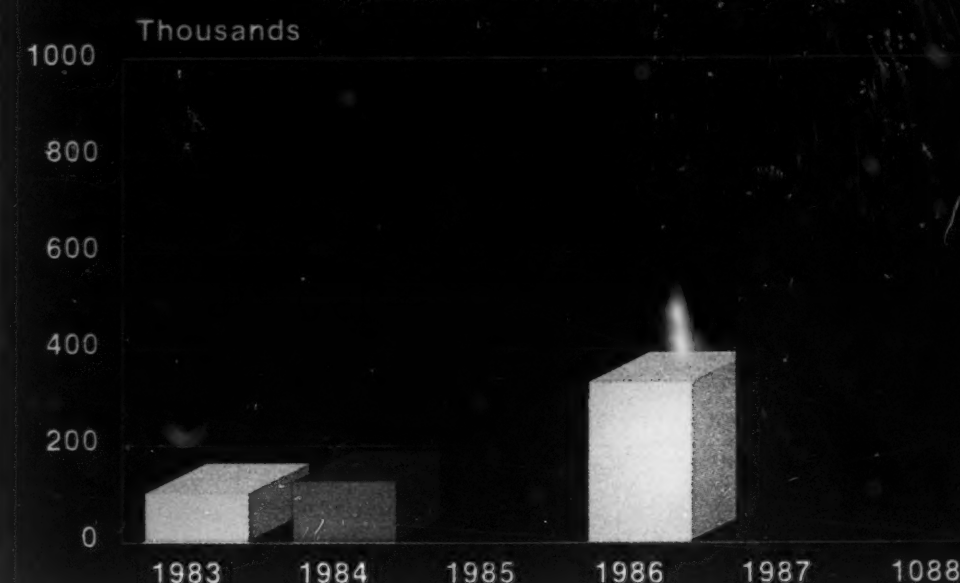
Air conditioning condensing units of 5 tons and under — 70,046 units (44,701 in 1987): Canada 28,642; Britain 1,887; United Arab Emirates 7,459; Taiwan 2,079; and Mexico 1,598.

Air conditioning condensing units of more than 5 tons — 8,857 units (7,787 in 1987): Canada 4,887; Saudi Arabia 466; United Arab Emirates 379; Mexico 264; and Hong Kong 256.

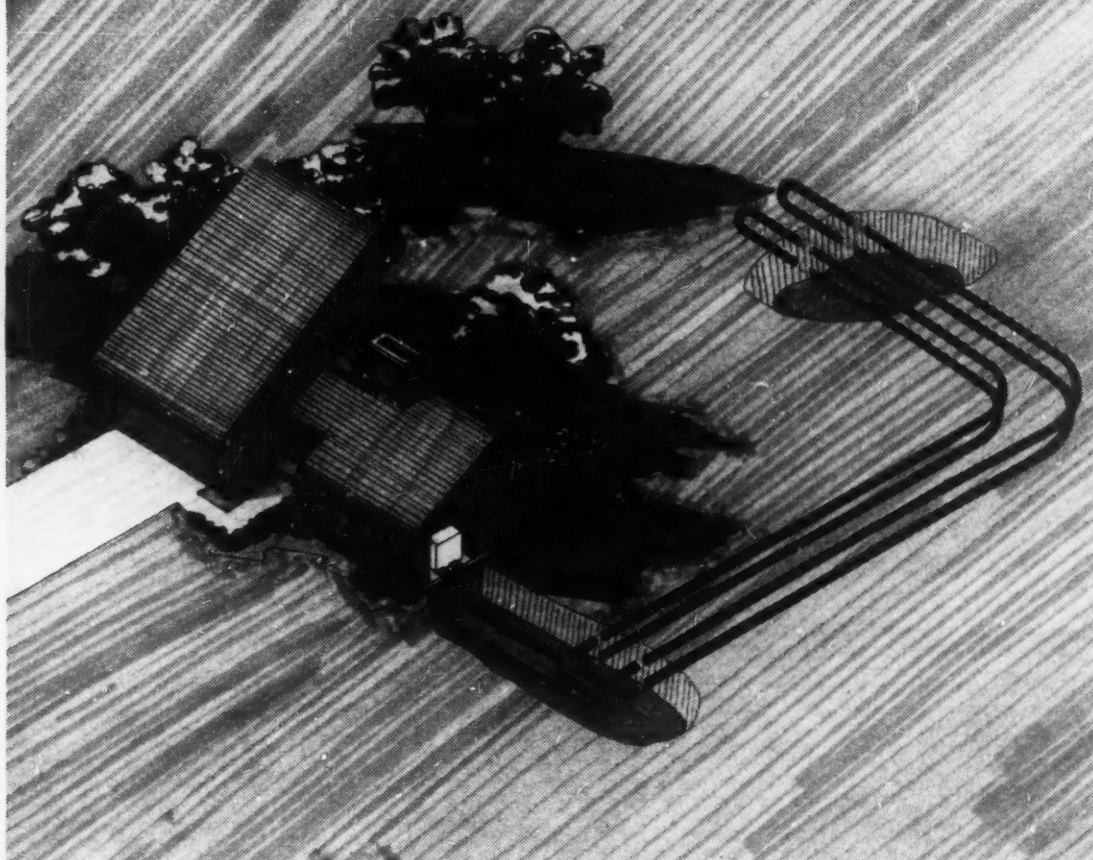
Room fancoil units — 35,614 units (21,455 in 1987): Canada 8,745; Mexico 3,890; Saudi Arabia 3,129; Taiwan 2,739; Egypt 2,140; and Hong Kong 2,059.

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Circle 24

INTERNATIONAL

nals — 10,339 units (12,585 in 1987): Hong Kong 2,056; Saudi Arabia 1,706; Australia 1,664; and Mexico 1,341.

Central station air handlers — 4,063 units (3,701 in 1987): Saudi Arabia 770; Canada 646; Taiwan 353; Aruba 232; Mexico 227; United Arab Emirates 151; and Turkey 140.

Centrifugal liquid chillers —

1,453 units (1,007 in 1987): Taiwan 407; Canada 164; China 127; Thailand 113; and Hong Kong 113.

Absorption liquid chillers — 118 units (74 in 1987): Mexico 23; Taiwan 21; Ecuador 16; and France 12.

Reciprocating liquid chillers — 2,240 units (1,527 in 1987):

Canada 303; Saudi Arabia 291; Hong Kong 252; United Arab Emirates 168; and Spain 100.

Of the \$277 million in **air conditioning machinery and parts** (\$220.3 million in 1987), Saudi Arabia accounted for \$56.3 million; Canada \$33.5 million; Mexico \$25.7 million; Venezuela \$12.3 million; France \$11.6 mil-

lion; Taiwan \$11.2 million; West Germany \$7.9 million; and Hong Kong \$7.2 million.

Ice-making machines — 24,085 units (22,024 in 1987): Canada 7,826; Mexico 1,882; Taiwan 1,572; Britain 1,334; and Jamaica 650.

Drinking water coolers — 147,365 units (135,647 in 1987):

Canada 77,290; Saudi Arabia 23,449; Singapore 5,282; United Arab Emirates 4,123; Trinidad 3,151; Spain 1,967; and Mexico 1,396.

Commercial refrigerators and freezers — 32,466 units (no comparison available): Canada 8,859; Saudi Arabia 3,357; Britain 2,544; and Japan 1,980.

WHOLESALE

Air conditioning and refrigeration parts-and-supplies wholesalers report that dollar volume in 1989 should increase over last year's total volume by 9.1%, according to a forecast by 47 members of the Air-Conditioning and Refrigeration Wholesalers (ARW).

The forecasted volume increase varies for the five regions of the

United States, from 3.9% in the Central region to 15.8% in the West. Increases for the other regions: Northeast 11.6%; Southeast 10%; and Southwest 10.9%. Canadian members are looking for a 14.8% increase in 1989.

Wholesalers expect the median rate of inflation this year to be 4% — almost identical to the average

of 3.8%. The median for those in the West was 5.9% and, in the Southwest, it was 3.5%.

Over past years, ARW has kept tabs on how well its forecasts have matched up with actual experience. Here are the forecasts for five of those years together with the actual sales performance for that year, based on ARW's oper-

ating survey, in parentheses: 1987 — 8.4% (6.9%); 1986 — 9% (2.2%); 1985 — 9.5% (4%); 1984 — 11.5% (14.1%); and 1983 — 7.4% (12.6%).

It should be noted that sales volume responses have been weighted to more accurately take into account the fact that wholesalers vary widely in both size and location. For example, a firm with

\$20 million in sales that projects a 10% increase would be given twice the value, or weight, of a firm projecting the same increase but with only \$10 million in volume.

Because ARW wholesalers traditionally have been oriented toward parts and pieces, their busi-

(Page 55, Please)

Bureau of the Census data

A 10-year look at air conditioning and refrigeration unit shipments

Product	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Condensing units	537,082	497,833	455,695	439,714	379,787	458,538	440,388	415,666	424,052	399,799
Compressors and compressor units	25,790,862	24,970,111	19,829,319	21,233,348	17,433,817	20,690,897	22,774,869	19,738,483	22,939,132	20,253,618
Ammonia compressors	1,819	2,014	1,860	1,808	1,509	1,173	1,233	1,140	1,252	1,296
Screw compressors ¹	—	—	5,809	5,320	2,620	3,601	—	—	—	—
Fancoil units ²	186,827	178,719	245,127	253,832	207,232	214,799	209,001	185,263	205,731	228,342
Induction units ³	—	—	33,343	—	—	—	—	—	—	—
Central-station air handlers	52,441	60,266	60,841	59,866	58,961	56,301	53,413	59,008	61,363	59,206
Unitary air conditioners ⁴	3,226,998	3,057,009	1,881,465	1,991,507	1,568,838	2,067,152	2,448,677	3,419,063	3,668,380	3,479,369
Unitary heat pumps (air-to-air)	371,436	646,926	508,457	604,903	408,742	660,956	803,669	865,839	871,057	858,505
Water-source heat pumps	—	—	69,931	69,689	86,092	69,280	86,165	119,164	103,970	131,308
Packaged terminal air conditioners	148,332	183,274	143,212	143,427	135,741	150,073	184,780	119,123	145,591	137,859
Packaged terminal heat pumps ¹	—	—	—	32,439	52,512	58,753	93,549	96,155	105,984	107,277
Room air conditioners	4,030,423	3,757,102	3,178,993	3,722,509	2,883,156	1,888,075	3,039,491	2,665,825	3,053,412	2,721,745
Centrifugal chillers ⁵	2,975	3,141	4,200	3,938	3,893	4,089	2,289	4,025	3,903	3,726
Reciprocating chillers	9,003	9,695	12,325	12,090	11,668	10,533	13,788	14,064	12,604	12,665
Absorption chillers ⁶	470	392	279	239	199	135	153	131	—	—
Adsorption, open-type absorption	2,704	2,503	2,962	3,171	1,461	1,044	1,087	1,087	—	—
Cooling towers ²	9,906	—	12,185	15,381	11,222	11,344	10,853	11,063	10,348	10,040
Evaporative condensers	2,453	3,263	2,881	2,850	2,166	2,149	2,426	2,505	2,282	2,233
Mobile vehicle air conditioners	9,074,932	7,651,198	5,852,328	6,059,342	5,651,329	9,267,612	12,196,385	13,008,516	—	—
Mobile air conditioners for trucks, agricultural, construction equipment ³	1,298,198	1,352,198	764,942	834,174	1,064,381	1,557,060	1,948,655	2,154,467	—	—
Mobile vehicle refrigeration systems ^{3,6}	70,731	76,395	60,301	66,773	68,843	66,502	36,548	44,916	—	—
Recreational vehicle air conditioners ¹	—	—	93,919	119,566	142,227	156,689	173,914	172,833	177,842	213,626
Unit coolers ⁷	194,905	187,434	175,371	169,487	163,697	187,612	179,726	205,282	186,301	196,150
Ice-making machines	194,049	218,827	166,725	165,626	150,475	166,399	218,281	201,668	202,936	208,040
Drinking water coolers	373,885	411,887	409,782	432,733	373,560	429,258	528,043	564,743	595,386	740,614
Dehumidifiers	477,692	728,148	734,738	540,386	438,833	610,013	586,003	589,056	484,981	580,399
Humidifiers (central and self-contained) ¹	—	—	423,986	396,413	310,342	324,948	427,504	370,585	410,762	454,208

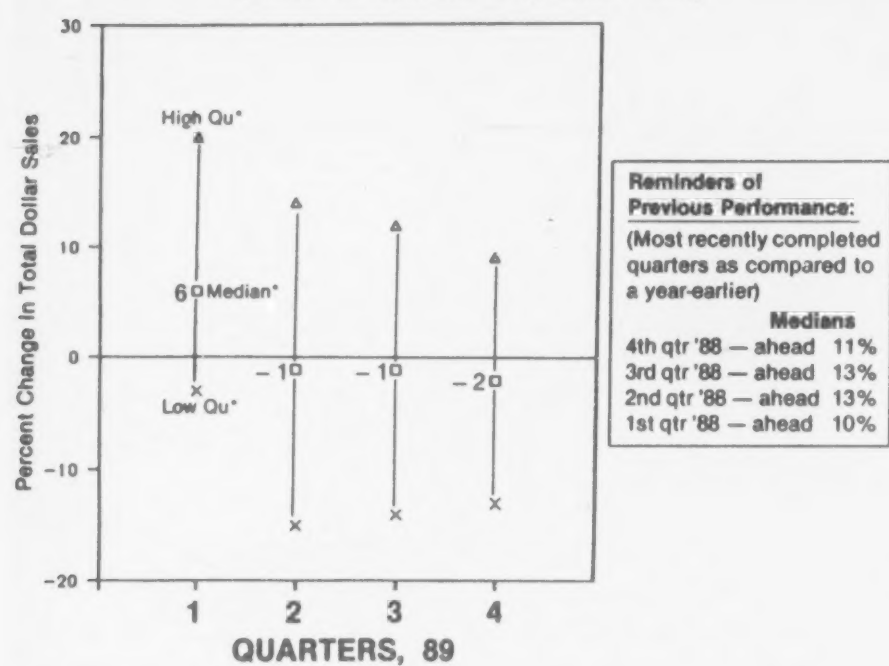
Source: Bureau of the Census Current Industrial Reports MA-35M, Air-Conditioning and Refrigeration Equipment, including Warm Air Furnaces. ¹New category since 1980. ²Includes vertical stack units. ³Withheld to avoid disclosing operations of individual companies. ⁴For years 1980 through 1984, add these figures to those for unitary heat pumps (air-to-air) and subtract exports to get comparable industry figures. ⁵Ex-

cludes open-type units. Also excludes units 200 hp and under and units 401 to 500 hp. ⁶Excludes railway freight cars. ⁷Excludes floor-mounted dry and spray types for 1979 and succeeding years. ⁸Grouped with adsorption, open-type absorption, in 1986.

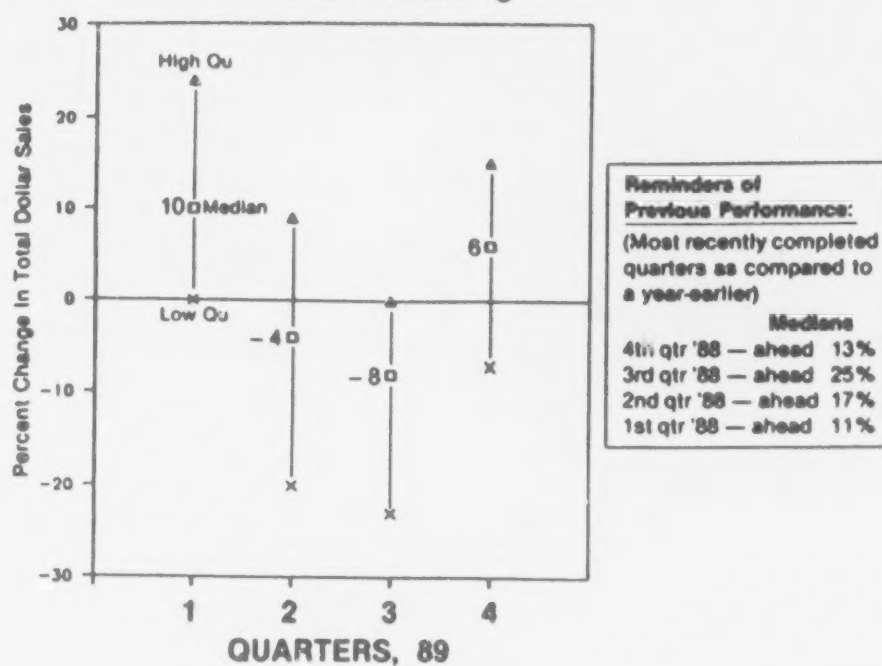
WHOLESALE

NHAW regional forecasts

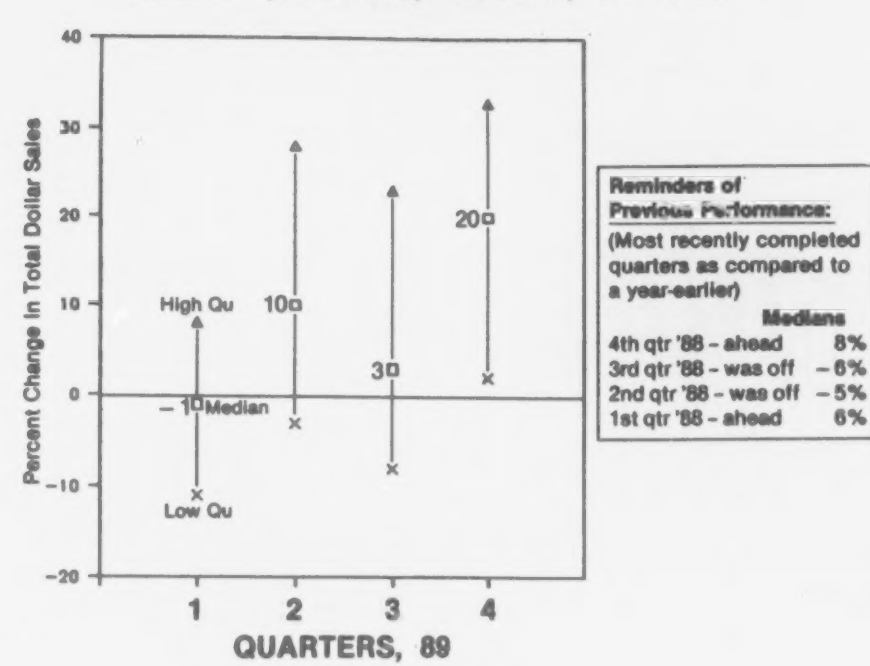
North America (all regions) forecast (when compared to identical quarter in previous year — first quarter to first quarter, second quarter to second to quarter., etc.)



Region 4
Ohio and Michigan

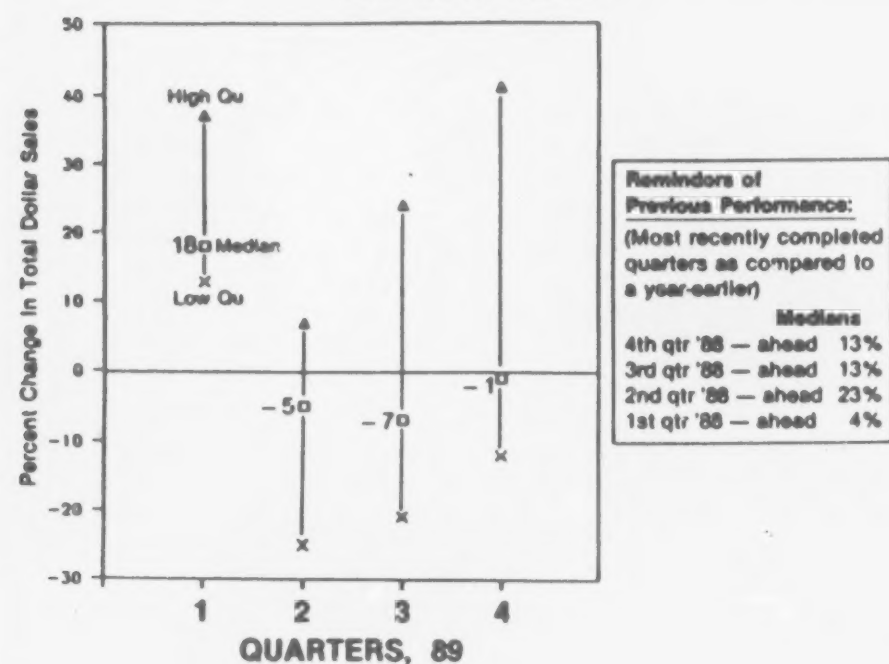


Region 8
Oklahoma, Arkansas, Louisiana, and Texas



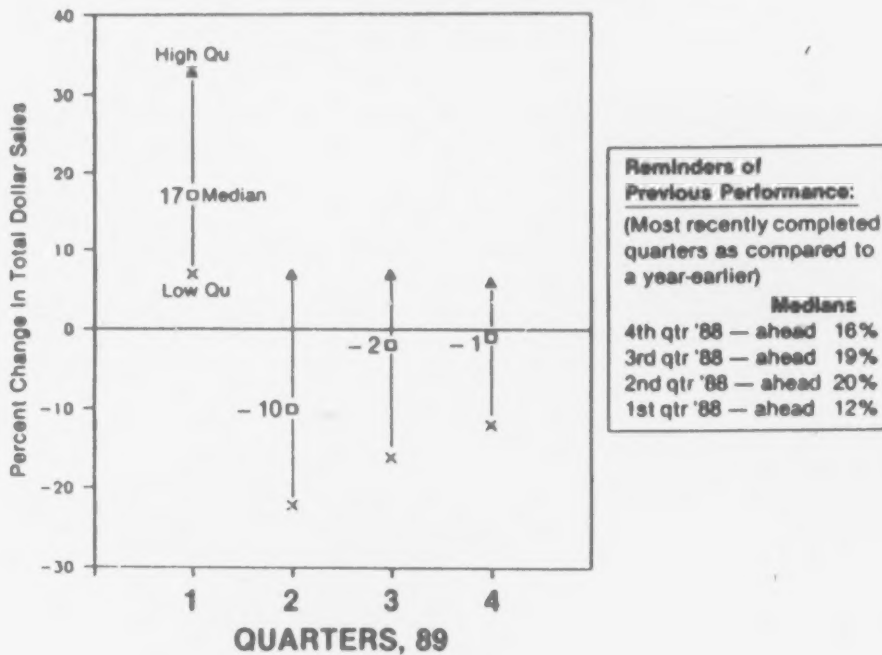
Region 1

Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island



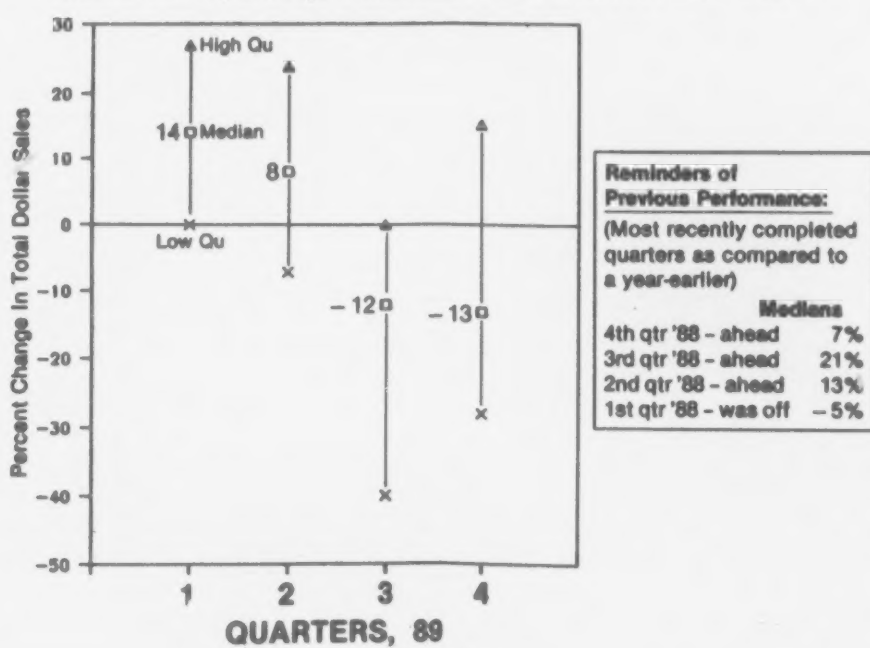
Region 5

Indiana, Illinois, and Wisconsin



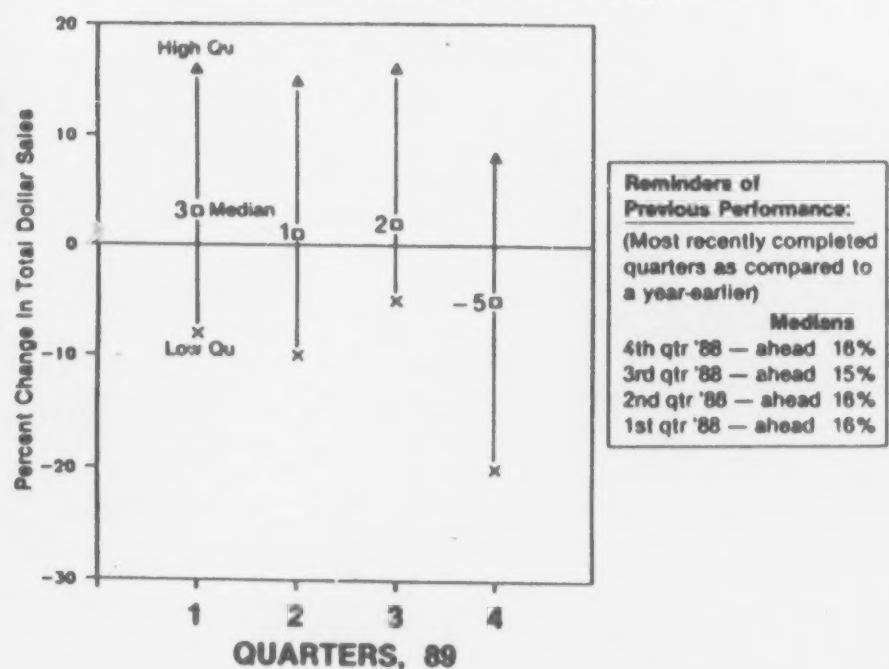
Region 9

Montana, Wyoming, Colorado, New Mexico, and Utah



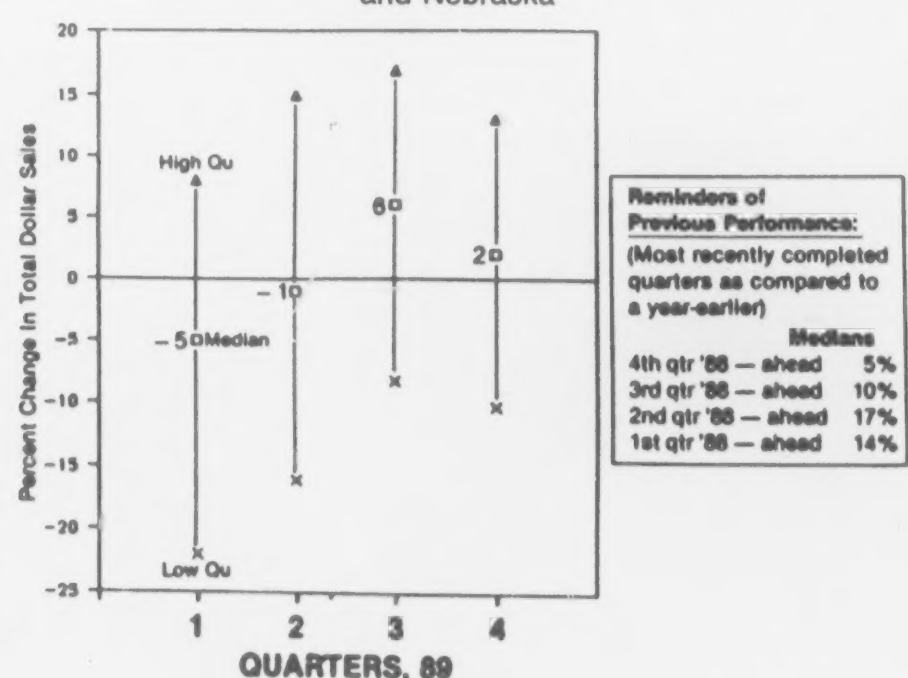
Region 2

New York, New Jersey, and Pennsylvania



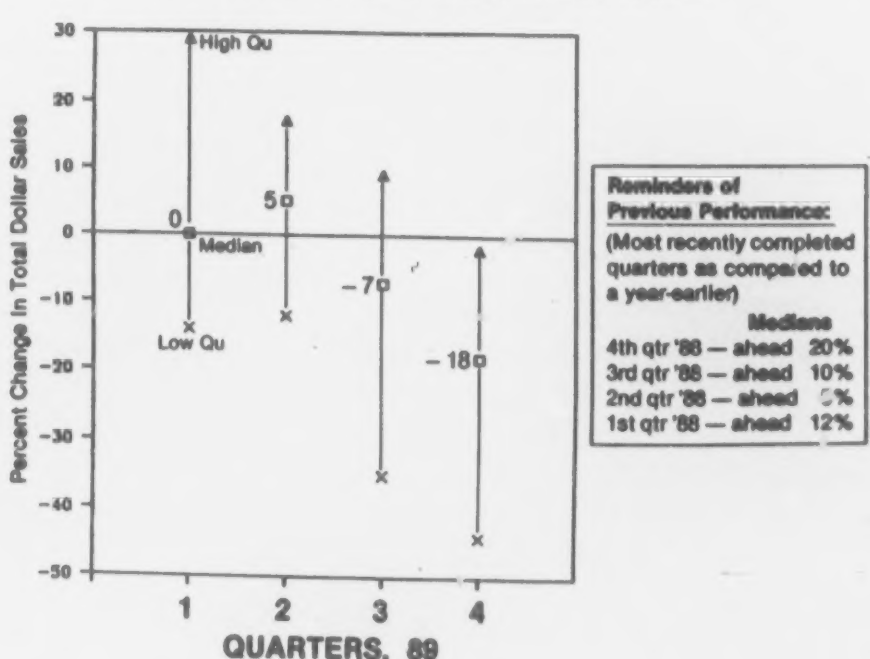
Region 6

Minnesota, Iowa, North Dakota, Missouri, Kansas, South Dakota, and Nebraska



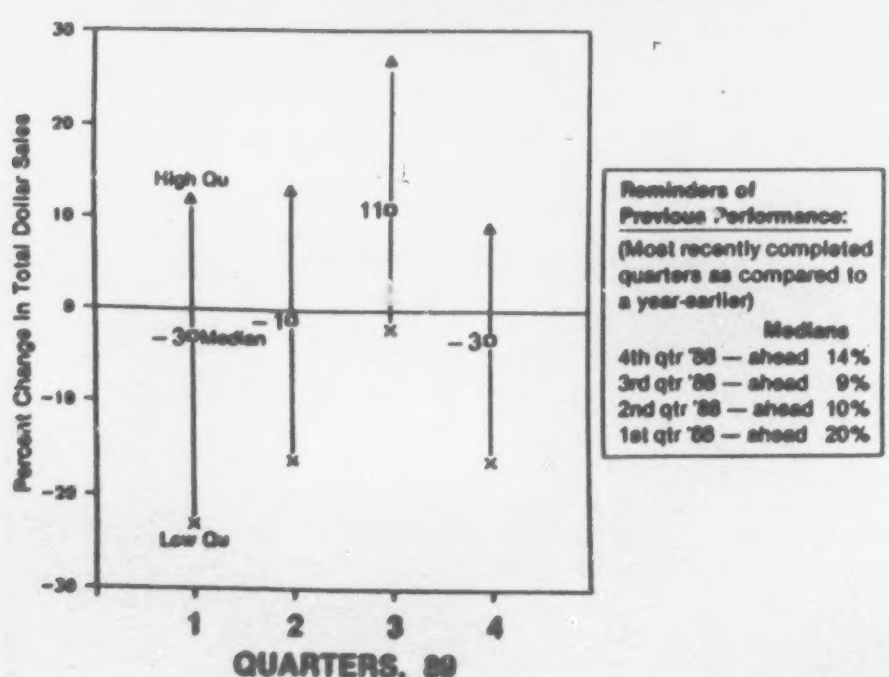
Region 10

California, Nevada, Arizona, and Hawaii



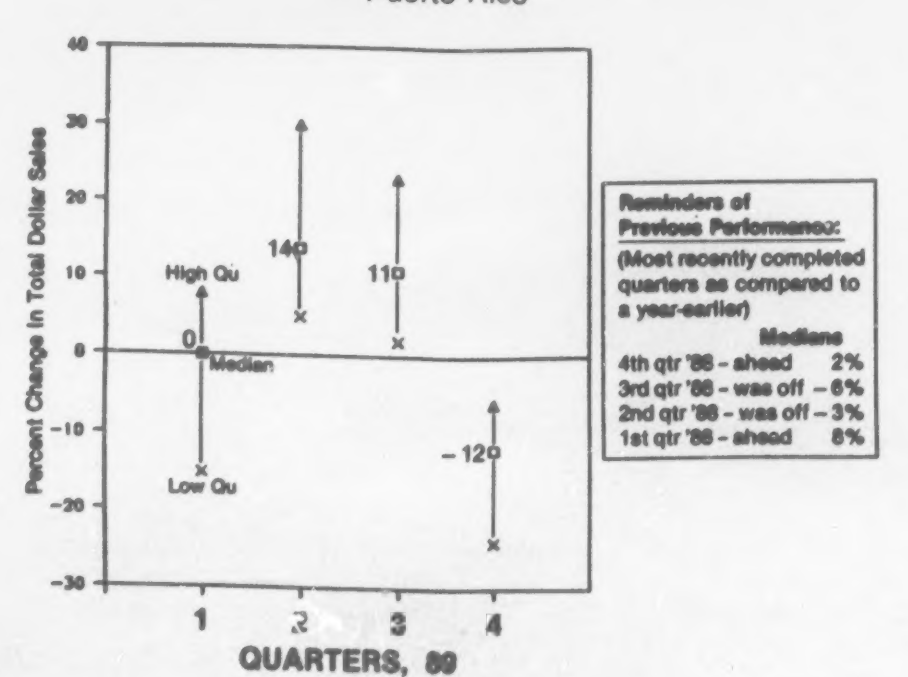
Region 3

Delaware, Maryland, West Virginia, Virginia, North Carolina, Kentucky, Tennessee, and District of Columbia



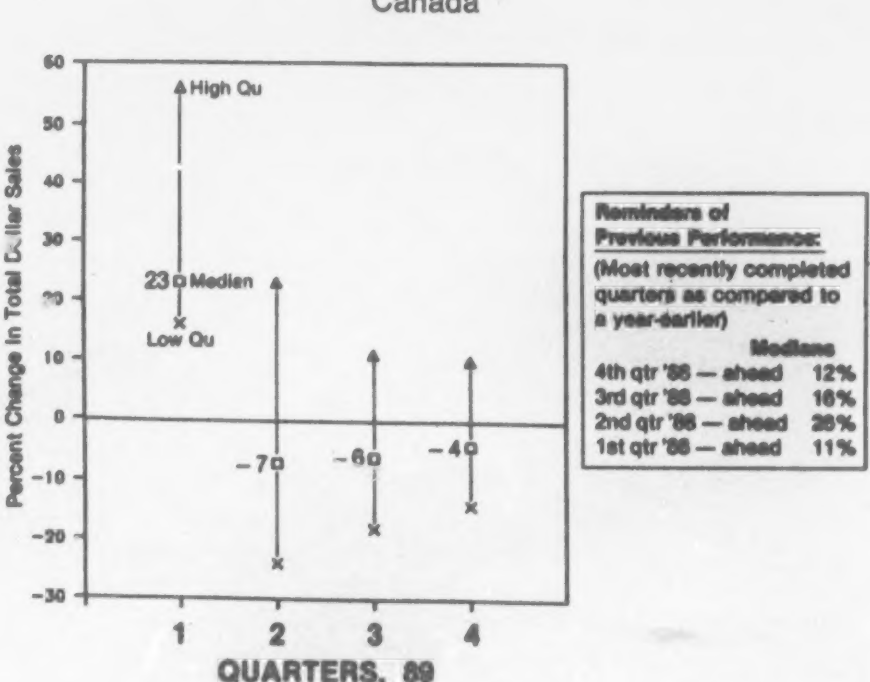
Region 7

Mississippi, Alabama, Georgia, South Carolina, Florida, and Puerto Rico



Region 11

Canada

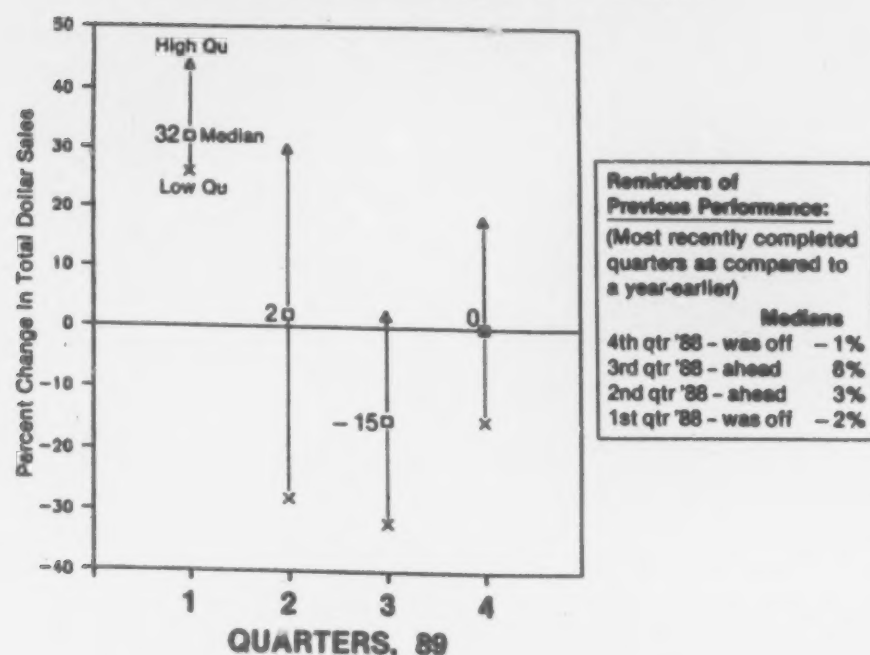


REGIONALITY was again prevalent in these forecasts supplied by the North American Heating and Airconditioning Wholesalers Association (NHAW). They depict the expectations of the upper quartile, lower quartile, and median of all reporting wholesalers in that region.

WHOLESALE

Region 12

Idaho, Alaska, Oregon, and Washington



(Continued from Page 53)

ness depends much more on the number of system repairs being made in a given year than on the much more volatile new construction equipment market. For this reason, ARW members tend to experience flat sales during recession years, rather than declines, and modest gains in boom years.

For example, when unitary air conditioner shipments declined by 21% in 1982, the average volume of ARW member companies increased by 2.2%. And when unitary shipments rebounded by 43% a year later, the increase for ARW wholesalers was a more modest 12.6%.

Looking across the national forecasts located in this section, the biggest anticipated increases are for unitary air conditioners and heating equipment with capacities of 4 tons and under, at 9.4%, and a related 9.8% increase for grilles, registers, and diffusers.

Significantly, ARW wholesalers anticipate only a 1% increase in refrigerant sales nationally. The Central and Southwest regions anticipate a slight decline in refrigerant sales while wholesalers in the Northeast are expecting a 10.2% increase.

The regions

On a regional basis, wholesalers in the West expect the anticipated 15.8% increase this year will come primarily from increased repair and maintenance components — filters and driers, refrigerant and temperature controls, pipe, tubing, and fittings. Refrigeration coils and water treatment chemicals also figure prominently.

Wholesalers in the Central region appear to have the least to cheer about. With the exception of an 8.2% increase expected for sheet metal and fittings, most other increases are in the 3% range. The Northeast expects a 16.4% hike in replacement compressor sales.

Canadian wholesalers, who expect a 14.8% sales increase this year, are most optimistic about unitary equipment of 4 tons and under (at 8%) and electric motors and pipe, tubing, and fittings (both at 7.5%). They expect a median increase in inflation amounting to 4%.

Some trends

A study conducted in 1987 for ARW by Arthur Anderson & Co. revealed that, in 1985, some 70% of its wholesaler members were using electronic data processing

systems, up from 50% only five years earlier. The shift in emphasis from outside to inside sales is expected to continue through 1995.

The study also indicated that a consolidation among wholesalers can be expected to continue. Anderson said the 320,000 wholesalers of all types (from groceries to appliances) will be reduced by 23% to 245,000 by 1995. Gross margins will remain stable, if somewhat reduced, during the same period.

Of those who will buy wholesale firms, Anderson said 43% will be other wholesalers seeking to expand their market share, 27% will be other wholesalers seeking economies of scale, 15% will be manufacturers seeking forward

integration, 8% will be firms from other industries, and 7% will be wholesaler customers seeking backward integration.

Between now and 1995, Anderson said traditional wholesaler functions will be reduced by 13% — from 78% of total volume to 68%.

The changes: direct mail and catalog sales will increase 60% (from 5% to 8% of total volume); retailing will increase by 25% (from 4% to 5% of volume); processing and manufacturing will increase by 33% (from 6% to 8%); and other operations, such as the sale of information, will increase by 57% (from 7% to 11%).

NHAW perspective

Members of the North American

Heating and Airconditioning Wholesalers Association (NHAW) reported that the median in 1988 sales over those of the previous year was 11.2% — almost identical to the 12% median increase in 1987. The average increase of 1988 was 13%.

NHAW relies more heavily on medians (the number in the middle when individual reports are arranged from low to high) than on averages (the arithmetic mean of all results). To avoid confusion, we'll stick with medians even though both medians and averages are included in the organization's reports.

The disparity among regions again was significant. For U.S. firms, the medians ranged from -

(Next Page, Please)

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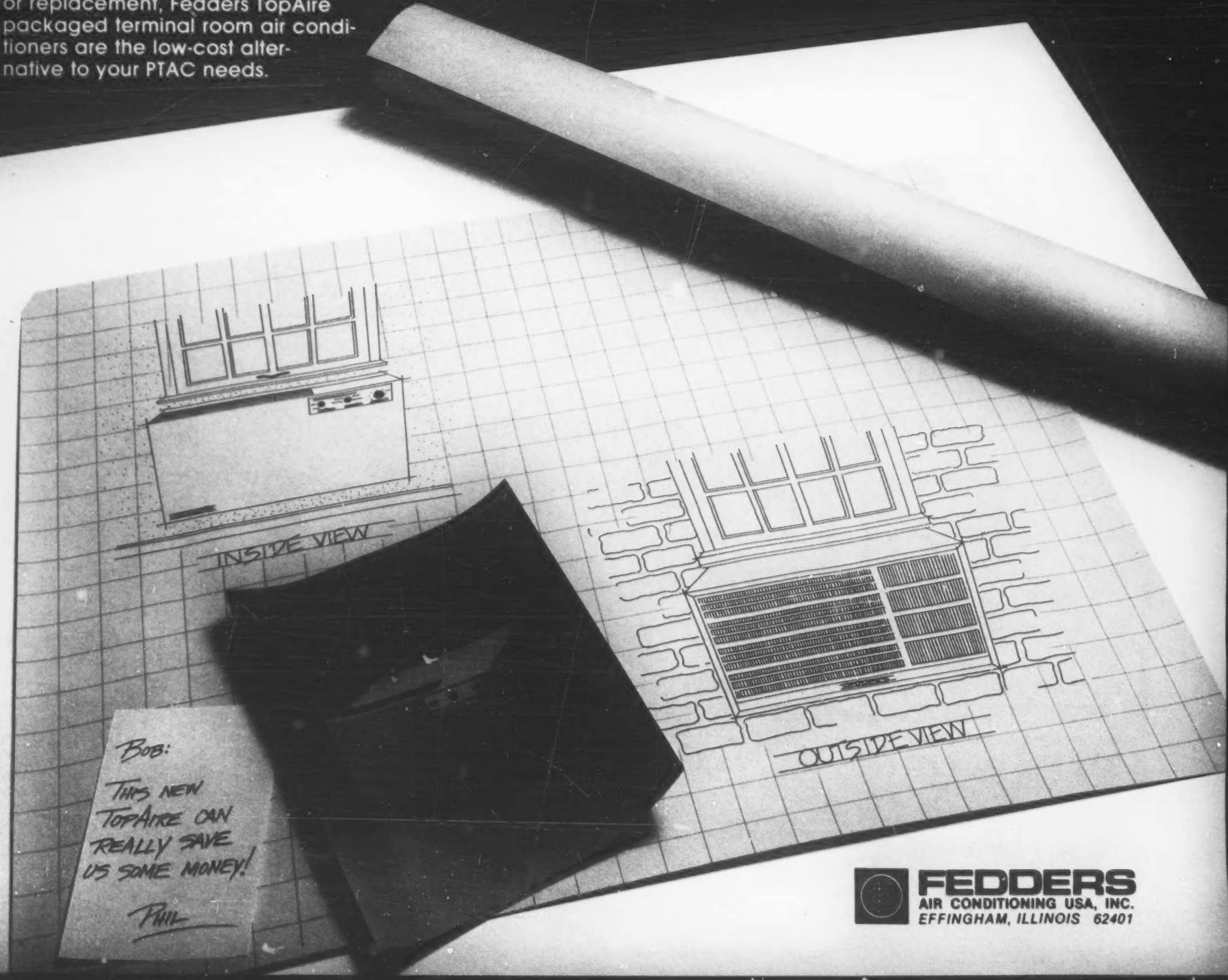
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WHOLESALE

(Continued from Preceding Page)

0.14% in Region 7 (Alabama, Georgia, South Carolina, Florida, Puerto Rico, and Mississippi) to a high of 18.97% in Region 1 (Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island) and 18.86% in Region 2 (New York, New Jersey, and Pennsylvania).

Other double-digit increases were recorded in Region 5 (Indiana, Illinois, and Wisconsin) at 17.14%; in Region 4 (Ohio and Michigan) at 15.79%; in Region 3 (Delaware, Maryland, West Virginia, Virginia, North Carolina, Kentucky, Tennessee, and the District of Columbia) at 11%; and Region 6 (Minnesota, Iowa, Nebraska, Missouri, Kansas,

ARW wholesale sales forecast

Product	North-east	South-east	Central	South-west	West	Total U.S.	Canada
Unitary AC&H equipment (4 tons and under)	N.A.	11.1	3.5	5.1	10.8	9.4	8.0
Unitary AC&H equipment (over 4 tons)	12.4	3.2	2.1	9.1	N.A.	4.7	4.5
Refrigeration condensing units	5.1	3.2	3.0	2.6	11.5	4.1	6.3
Refrigeration coils	7.9	3.9	3.0	2.2	10.8	4.3	4.9
Replacement compressors	16.4	3.7	3.5	4.9	9.1	5.2	4.8
Refrigerant	10.2	0.7	-1.1	-0.1	2.8	1.0	7.2
Driers, strainers, filters, and sight glasses	7.6	5.7	4.1	2.5	10.2	5.1	5.3
Refrigerant flow controls — TEV, solenoid, regulating valves, etc.	7.6	6.7	3.6	2.8	10.2	5.4	5.4
Pressure and temperature controls	11.8	9.3	3.3	1.0	10.1	6.7	5.1
Electrical controls — relays, contactors, and starters	12.3	3.8	3.4	3.6	11.9	4.9	6.6
Capacitors	9.5	3.5	3.2	2.2	8.3	4.1	6.6
Electric motors	4.9	4.6	4.0	2.6	9.9	4.7	7.5
Pipe and tubing fittings	14.3	7.4	3.1	0.7	12.3	6.2	7.5
Pipe and tubing insulation	9.7	7.4	2.7	0.1	11.4	5.5	6.9
Grilles, registers, and diffusers	N.A.	15.8	2.9	0.7	N.A.	9.8	N.A.
Sheet metal and fittings	N.A.	7.4	8.2	1.6	N.A.	6.8	N.A.
Air filters and air cleaners	N.A.	4.9	3.6	0.9	8.9	6.8	N.A.
Water treatment and maintenance chemicals	-0.3	1.5	4.5	2.1	11.7	3.3	2.5
Instruments and test equipment	4.2	4.1	3.6	0.6	7.2	3.8	2.3
TOTAL SALES (% change)	11.6	10.0	3.9	10.9	15.8	9.1	14.8

1989 SALES FORECAST undertaken by members of the Air-conditioning and Refrigeration Wholesalers (ARW) shows an overall gain of 9.1% in dollar volume over 1988. A total of 52 firms submitted data. The figures represent the weighted average (by sales volume) of all responses. Total sales represent the arithmetic average of all wholesaler estimates of 1989 total sales and are not an aggregate of the product categories.

North and South Dakota) at 10%. Lesser increases were recorded in Region 10 (California, Nevada, Arizona, and Hawaii) at 9%; Region 9 (Montana, Wyoming, Colorado, New Mexico, and Utah) at 5.03%; and Region 8 (Oklahoma, Arkansas, Louisiana, and Texas) at 3.34%. Canadian NHAW members posted an 11% median increase last year over 1987 dollar sales.

In terms of firm size, the disparity was less pronounced. If a generalization could be ventured, it would be that medium-sized firms — those with annual sales volumes from \$3 million to \$7.5 million — performed best in 1988. The largest firms (sales of more than \$10 million) were not far behind and the smallest firms fared poorest.

1988 forecast

Looking ahead, NHAW provides a quarter-by-quarter comparison of total sales — nationally and by region — compared to the identical quarter in the previous year. No longer does it provide forecasts according to product groupings.

As can be seen in the accompanying charts, the North American outlook is for a median increase of 6% in dollar sales in the first quarter followed by three quarters of modest declines. This is in sharp contrast to 1988 performance, which reflected steady 10% to 13% increases.

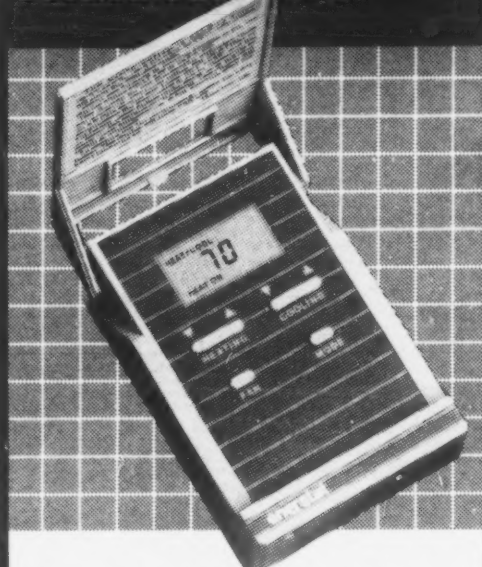
In a broad sense, then, NHAW members expect 1989 sales to be flat.

The forecast is prepared for NHAW by William Spooner and Associates, Inc. It relates data supplied by NHAW members with econometric models maintained at the University of California at Los Angeles (UCLA), which develops a forecast for the nation based on the DRI econometric model.

Again, there is wide disparity among regions. The Northeast, which led the nation last year, is expecting small declines in all but the first quarter. Region 8, which includes the oil-producing states, is expecting a strong recovery after the first quarter.

In the West, and in the Mountain states, a relatively strong first half of the year is expected to be followed by a much weaker second half. Canada expects to mirror U.S. performance and, obviously, the Midwest expects more normal summer weather after two scorches in a row.

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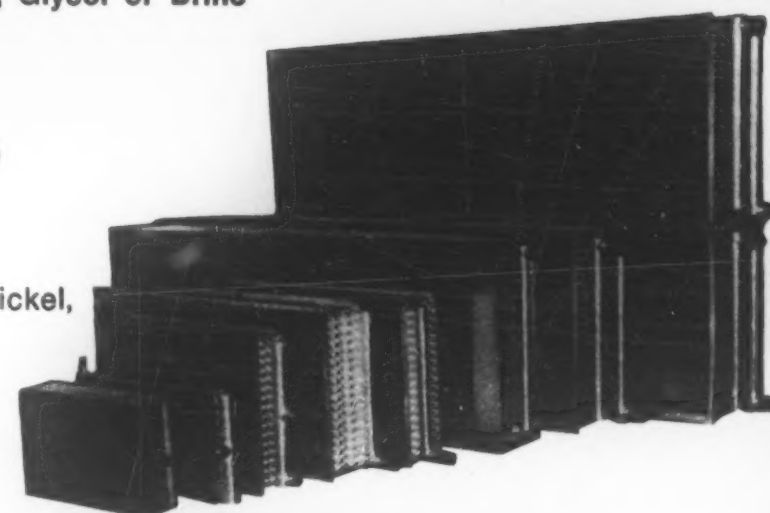
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FUELS AND ENERGY

United States energy consumption for the first 11 months of 1988 was 72.716 quadrillion Btu (quads), an increase of 4.4% over the 69.635 quads consumed during the same period in 1987, according to the Energy Information Administration (EIA).

To add some perspective, the nation's energy consumption for the full year of 1987, at 76.781 quads, was only 3.4% more than the 74.282 quads consumed in 1973, the year of the Arab oil embargo. Both totals are considerably below the peak consumption total of 78.898 quads set in 1979, just after the second major oil price shock.

In the residential and commercial sector (the Energy Information Administration lumps them together), the 26.316 quads consumed during the first 11 months of 1988 was 5.4% more than the 24.974 quads consumed by this sector during the same period of 1987. The 1987 full-year total of 27.75 quads represents a 15% increase over the 24.143 quads used by the residential-commercial sector in 1973.

During the first 11 months of 1988, this sector represented a 36.2% share of total energy consumption, up a bit from the 35.9% share for the same period of 1987 and up considerably from the 32.5% share for this sector in 1973.

Industrial sector consumption of 26.429 quads for the first 11 months of 1988 was up 5.2% over the 25.116 quads consumed by this sector during the same period of 1987. The full-year 1987 total of 27.656 quads was 12.3% lower than the 31.527 quads consumed by the industrial sector in 1973.

During the first 11 months of 1988, the industrial sector represented a 36.4% share of total energy consumption, almost the same as the 36% share for the same period a year earlier. In 1973, the industrial sector consumed 42.4% of the nation's energy.

For the record, the transportation sector consumed 19.982 quads during the first 11 months of 1988, a 2.3% increase over the 19.554 quads consumed by this sector during the same period in 1987. It represented a 27.4% share of total energy consumption for the 1988 period, down from 28% for the same period in 1987. The share in 1973 was 25%.

Electric utilities consumed 26.321 quads of energy during the first 11 months of 1988, an increase of 4.4% over the 25.2 quads consumed during the same period of the previous year. The 1987 full-year total of 27.564 quads was 38.8% more than the 19.852 quads consumed by electric utilities in 1973.

Of the 26.316 quads consumed by the residential-commercial sector during the first 11 months of 1988 (with the share for the same period a year earlier in parentheses), only 0.59% (0.58%) was coal, 24.9% (24%) was natural gas, 9.13% (9.25%) was petroleum, 19.9% (20.2%) was electricity, and 45.5% (46%) was electrical system generation and transmission losses.

Similarly, the 26.249 quads used by the industrial sector during the same periods broke down this way: 9.65% (9.5%) was coal, 26.84% (25%) was natural gas, 29% (30.3%) was petroleum, 10.5%

(10%) was electricity, and 23.9% (24.3%) was electricity generation and transmission losses.

Conservation

In order to get a gross measure of conservation, the Department of Energy (DOE) records show that, in 1973, it took 27,440 Btu to generate each 1982 constant dollar of GNP (gross national product). In the third quarter of 1988, it took 20,100 Btu to generate a constant dollar of GNP, or 26.8% less than in 1973. The 1988 figure was virtually identical to that recorded at the same time a year earlier.

In simpler terms, the calculation shows that the U.S. economy in the third quarter of 1988 produced at a rate of 4.009 constant 1982

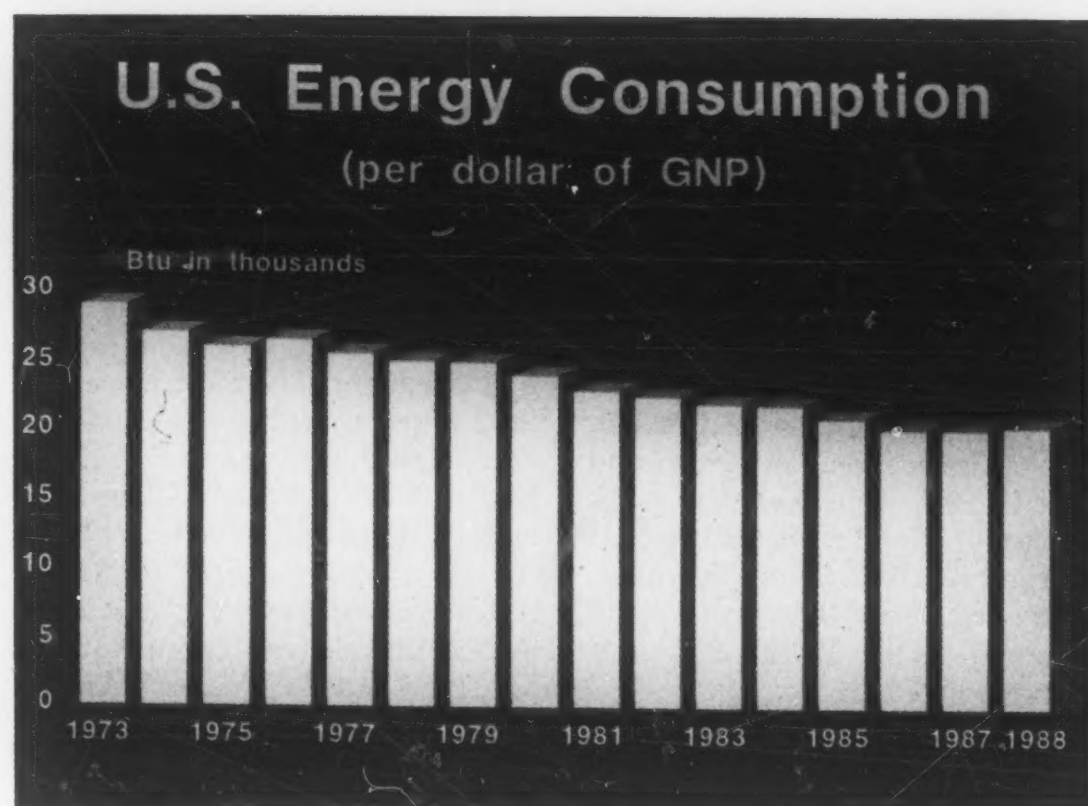
dollars' worth of goods and services with 26.8% greater energy efficiency than in 1973. Had it not been for this energy efficiency improvement, U.S. energy consumption in the third quarter of 1988 would have been at the rate of 101.9 quads instead of the actual 80.372 quads.

Fuel costs

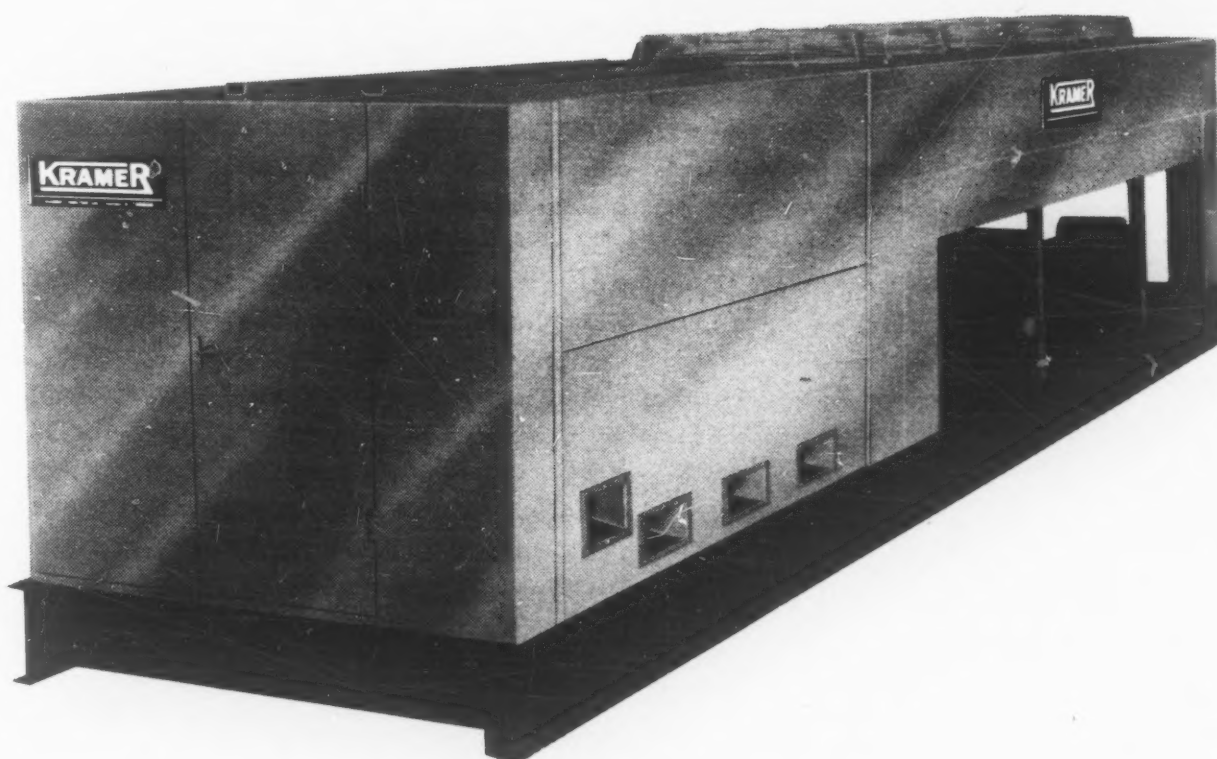
The average residential price of No. 2 fuel oil in November, 1988, was 76.7 cents/gal, down 8.1% from the 83.5 cents/gal charged in the same month a year earlier. The 1988 price was 31.3% less than the \$1.12 charged in November, 1985.

It also represents a 35.2% drop from the average price of \$1.94/gal

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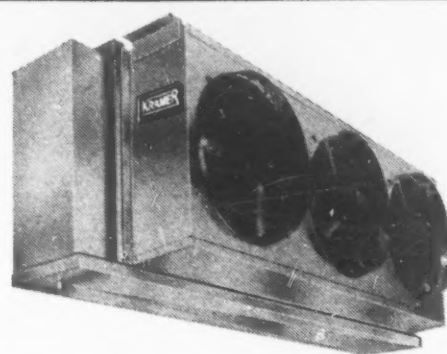
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KRAMER REFRIGERATION

FUELS AND ENERGY

(Continued from Preceding Page)

charged in 1981. The cost of No. 2 fuel oil in 1978, just before the second oil price shock, was 49 cents/gal.

In November, 1988, the average price of natural gas to homes was \$5.51/1,000 cu ft, a 1.7% increase over the \$5.42/1,000 cu ft paid in the same month a year earlier. The increase follows declines in each of the previous two years and is still 10% less than the peak average of \$6.12/1,000 cu ft charged in 1985. The November, 1988, price was, however, 327% higher than the \$1.29/1,000 cu ft charged in 1973.

The average price charged commercial customers in November, 1988, was \$4.67/1,000 cu ft, the

same as in November, 1987. It was 16.5% lower than the peak price of \$5.59/1,000 cu ft in 1983, but 397% higher than the 1973 price of 94 cents/1,000 cu ft.

The average price charged industrial customers in November, 1988, was \$3.03/1,000 cu ft, an increase of 4.8% over the \$2.89/1,000 cu ft charged in the same month a year earlier. The 1988 price was 28.2% less than the peak price of \$4.22/1,000 cu ft set in 1984, but 506% more than the 50 cents/1,000 cu ft paid in 1973.

The average price charged residential customers by privately owned electric utilities in November, 1988, was 7.72 cents/kWh, almost the same as the 7.66 cents/kWh charged in the same month a year earlier. The increase

follows a marginal drop in 1987 and a 5.5% decline in 1986.

The 1988 average, however, was 79% higher than the 4.31 cents/kWh charged in 1978 and 204% higher than the 2.54 cents/kWh charged in 1973.

The average price electric utilities charged commercial customers in November, 1988, was 7.07 cents/kWh, a decline of 2.6% from the 7.26 cents/kWh charged in November, 1987. The 1988 price represents a 62.2% increase over the 1978 price of 4.36

cents/kWh and a 193% increase over the 2.41 cents/kWh paid in 1973.

Similarly, the average price electric utilities charged industrial customers in November, 1988, was 4.58 cents/kWh, a 2.1% decline from the 4.68 cents/kWh charged in the same month a year earlier. The 1988 price represents a 64.2% increase over the 1978 price of 2.79 cents/kWh and a 266% increase over the 1.25 cents/kWh charged in 1973.

Residential fuel prices expressed

in constant 1982-1984 dollars present a better view of what has happened to relative fuel prices. They are taken from the Consumer Price Index figures compiled by the Bureau of Labor Statistics.

According to the Bureau, the cost of electricity, at 6.61 cents/kWh in 1978 and 6.63 cents/kWh in the third quarter of 1988, has increased by only 0.3%. The cost of one million Btu in 1978 was \$19.37 and, a decade later, it was \$19.44.

The cost of natural gas, at

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HERNDON, VIRGINIA
8 A.M., WEDNESDAY, AUGUST 31.

Greg Frankhauser of Warner Mechanical needs a fan by noon Friday to avoid job cost penalties. He calls Tim Krothe of H&B Products, Greenheck's representative in Springfield, Virginia.

SPRINGFIELD, VIRGINIA
8:47 A.M., SAME DAY.

Krothe sends "Quick Delivery" (Q.D.) order by facsimile to Greenheck's Schofield, Wisconsin headquarters.

SCHOFIELD, WISCONSIN
10:18 A.M., SAME DAY.

Greenheck processes order and uses computer link to print the shipping order from its regional distribution center in Greensboro, North Carolina.

GREENSBORO, NORTH CAROLINA
3:10 P.M., SAME DAY.

Fan is shipped to Warner Mechanical in Herndon, Virginia.

HERNDON, VIRGINIA
11:35 A.M., FRIDAY, SEPTEMBER 2.

Warner Mechanical receives the fan and installs it immediately. No job cost penalties were incurred.

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Circle 18

Future prospects are mixed for oil, gas, and electricity

World oil prices in the \$15/barrel range represent a mixed blessing for the United States.

Obviously, it means relatively low prices for those who use petroleum-based products, including heating oil and gasoline. But it also means that the U.S. oil industry will continue to be depressed and dependence on foreign suppliers will grow more rapidly.

In late 1988, OPEC adopted new production quotas for member countries and pledged to cut back production from 22 to 18.5 million barrels/day in an attempt to get world prices up to \$18/barrel. Most believe, however, that it's just a matter of time before some members start cheating again and the agreement collapses.

EIA predicts that, by the year 2000, oil prices will reach \$31/barrel (in constant 1987 dollars), the same level as in 1984. Political uncertainties aside, it's unlikely that world oil prices will exceed \$17/barrel — in constant

dollars — by 1993.

This means that, by the middle of the next decade, the U.S. probably will be importing more than half of its oil needs — a condition that puts continuing pressure on the trade deficit and domestic oil production.

The natural gas "bubble," a condition produced because domestic supply has exceeded demand by at least 1 trillion cu ft (tcf) in each of the past seven years, is showing signs of ending. Base prices for large users, which were reduced to stay competitive with oil, appear to have stabilized. It was helped by a growing number of producers bypassing utilities and selling directly to large end users.

A Colorado School of Mines study funded jointly by the Gas Research Institute and the Electric Power Research Institute indicates that, at an average price of \$4/1,000 cu ft in 1986 dollars, the contiguous 48 states have a potential undiscovered gas resource of 535 tcf over and above

the 160 tcf of proved reserves.

Supplemented by annual imports from Canada and Mexico of up to 2.5 tcf, such a resource base could meet a 19-tcf demand level for at least 40 years, according to the study.

GRI estimates that natural gas demand will grow from 17.6 quads in 1987 to 19.4 quads by 2010. Residential and industrial demand is expected to decline marginally during the period. Commercial demand is expected to grow by 25% and electricity generation needs could increase by 48%.

Gas-fired cogeneration, gas turbines for electric utility peaking needs, and increased gas usage for comfort cooling are among future market builders, the institute believes.

The real price of electricity nationally has been dropping since 1984 but, of an estimated 87,000 MW of extra electric generating capacity needed by 1995, only 60% is under construction. The utilities appear to be deeply concerned about financial risk.

Other developments may ease the situation.

In addition to the 500 systems already installed, cogeneration projects initiated in 1988 totaled \$5 billion and 3,000 MW. Waste-to-energy projects, with 50,000 tons/day already installed, initiated another 14 projects totaling 10,000 tons/day last year.

Additionally, there are in place 96 geothermal installations (2,400 MW), 16,000 wind generators (60 MW), photovoltaic installations (20 MW), a growing number of thermal storage systems, and a wide range of energy efficiency incentive programs designed to push back the time when extra generating capacity will be needed.

Electric utilities are keeping a close eye on an experiment being conducted by the Alabama Electric Cooperative, in which off-peak baseload power is being used to compress air in a 19 million-cu-ft underground salt dome.

During peak demand periods, the compressed air will be withdrawn, heated by gas or oil, and run through a turbine to produce relatively inexpensive peak power. Although storage systems might vary, such systems could be used in almost every area of the nation. They can also be put in place quickly.

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Circle 10

FUELS AND ENERGY

\$3.92/1,000 cu ft in 1978 and \$5.64/1,000 cu ft in the third quarter of 1988, increased by 43.7%. The cost of one million Btu increased from \$3.86 in 1978 to \$5.47/1,000 cu ft 10 years later.

The cost of home heating oil, at 75.2 cents/gal in 1978 and 63.3 cents/gal in the third quarter of 1988, dropped by 15.8%. The cost of one million Btu also declined from \$5.42 to \$4.56 during the same time span.

In constant dollars, the cost of natural gas has increased by 94.2% from \$2.90/1,000 cu ft (\$2.85/million Btu) in 1973. Similarly, the cost of electricity increased by 15.9% from 5.72 cents/kWh (\$16.77/million Btu) in 1973.

Electricity

Total net electricity generation for the first 11 months of 1988, the latest period for which these EIA data were available, was 2,468,371 million kWh, an increase of 5% from the 2,351,626 million kWh total for the same period in 1987.

Electricity sales to ultimate customers, at 2,350,933 million kWh for the first 11 months of 1988, also was up 5% from 2,250,627 million kWh for the same period a year earlier.

Of the 2,468,371 million kWh of electricity generated in the first 11 months of last year, 56.7% came from coal (56.9% a year earlier), 5.3% came from petroleum (4.6% in 1987), 9.7% came from natural gas (10.8% in 1987), 19.6% came from nuclear fuel (17.6% in 1987), 8.23% came from hydroelectric plants (9.7% in 1987), and 0.55% came from other sources (0.5% in 1987).

Of the 2,350,933 million kWh of electricity sold in the first 11 months of 1988, residential sales (with a 34.6% share) amounted to 812,676 million kWh, up 4.7% from 776,513 million kWh for the same period in 1988.

Commercial sales (with a 27.7% share) totaled 652,130 million kWh for the 1988 period, up 5.3% from 619,245 million kWh. And industrial sales (with a 34.5% share) totaled 810,928 million kWh for the 1988 period, up 4.6% from 775,267 million kWh. Other sales (with a 3.2% share) amounted to 75,198 million kWh in the 1988 period, down 5.5% from 79,601 million kWh.

The net summer generating capability of the electric utility industry in the third quarter of 1988 was 678,318 MW (megawatts), up 0.7% from the same period a year earlier. Similarly, the net winter generating capability in the third quarter of 1988 was 689,431 MW, up 0.6% from the third quarter of 1987, according to Edison Electric Institute (EEI).

The institute reported that, in the third quarter of 1988, the average number of electric utility customers was 105,642,000, an increase of 1.8% over the 103,815,000 customers at the same time a year earlier.

EEI reported that weekly electric utility output for the contiguous 48 states for the 52 weeks ended Dec. 31, 1988, was 2,774,140 million kWh, a 5% increase over the previous year's performance. The largest increase, at 7.3%, was in the West Central region. Increases of 6.5% in the

Pacific Northwest and 6% in New England also were recorded. The smallest increase, at 3.5%, was in the South Central region.

Nuclear

In November, 1988, U.S. nuclear generating units produced 39,578 million net kWh, an increase of 6% over the 34,944 million net kWh total for the same month a year earlier.

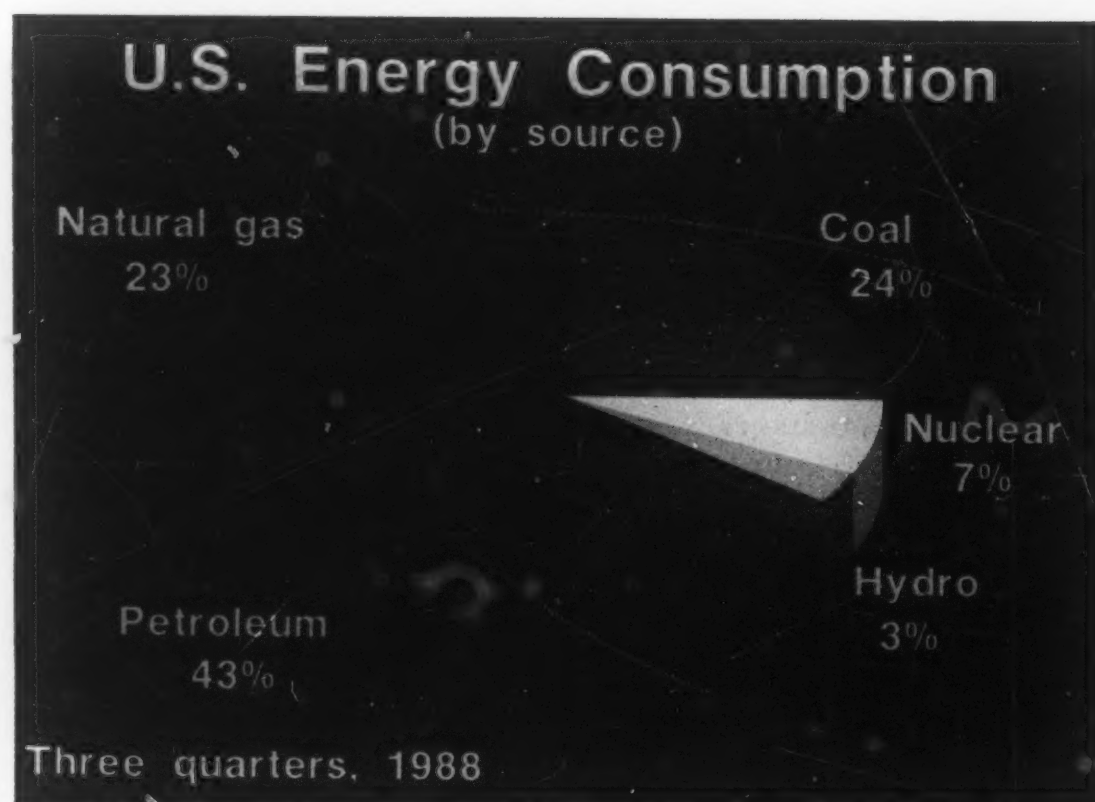
Also last November, nuclear units generated electricity at an average capacity factor of 58%, or 2% better than in November, 1987. Nuclear power supplied 18.9% of the total electricity generated in November, 1988, up from 18.7% in the same month a year earlier.

As of Nov. 30, 1988, there were 108 operable nuclear generating units in the U.S. with a net collective generating capacity of 95 million kWh. On the same date, there were 126 domestic nuclear generating units in all stages of planning, construction, and operation, with a total design capacity of 118 million kWh.

Natural gas

Gas utility thermal equivalent sales in 1988 were forecast at 10,776.6 trillion Btu, a 2.2% increase over the total of 10,543.2 trillion Btu for 1987, according to preliminary figures released by the American Gas Association (AGA). The total for 1988 also

(Next Page, Please)



FUELS AND ENERGY

(Continued from Preceding Page)

represents a 14.6% drop from the 1985 total of 12,615 trillion Btu.

It should be noted that an additional 4,065.5 trillion Btu equivalent was recorded in 1988 for transportation, an increase of 17.8% over the 1987 transportation total of 3,451.4 trillion Btu. Much of this increase represents direct sales by producers to large commercial and industrial customers that bypass local utilities. It's a principal tactic producers use to retain these large customers in the face of lower oil prices.

Industrial sales (21.8% of the total) amounted to 2,343.8 trillion Btu in 1988, up 0.2% from 2,338.8 trillion Btu a year earlier. The industrial sector's share of total sales was 26% in 1986. Sales of gas for electricity generation (11.9% of the total) in 1988 totaled 1,286.8 trillion Btu, down 14.6% from a total of 1,509.1 trillion Btu in 1987. This sector's share in 1986 was 13%.

Residential sales (43.5% of the total) for 1988 amounted to 4,687.9 trillion Btu, an increase of 6.9% over the previous year's total of 4,384.8 trillion Btu. The residential sector had a 39.4% market share in 1986.

Commercial sales (21.3% of the

total) in 1988 amounted to 2,294.4 trillion Btu, an increase of 6.4% over the 2,155.8 trillion Btu total for 1987. Electricity generation sales (11.9% of the total) in 1988 totaled 1,288.8 trillion Btu, down 14.6% from 1,509.1 trillion Btu in 1987. The "other" category (1.5% of the total) amounted to 161.7 trillion Btu in 1988, up a hair from the 1987 total of 154.7 trillion Btu.

AGA reported that the December, 1988, average natural gas utility prices, expressed in dollars/million Btu (and with December, 1987 prices in parentheses), were: all \$4.29 (\$4.32); residential \$5.30 (\$5.39); commercial \$4.63 (\$4.76); industrial \$2.92 (\$3.11); electricity generation \$2.65 (\$2.51); and other \$3.40 (\$3.42).

Exploration

Total exploration and development well completions in 1988 amounted to 30,950 wells, a decline of 9.6% from the revised total of 34,240 wells completed in the previous year. Both years are dramatically lower than the 90,130 well completions in the peak year of 1981.

Oil well completions in 1988, at 13,940, were down 12.7% from the 15,960 wells completed in 1987. The 7,310 gas wells completed last year represented a 1.9% decline

from the 7,450 gas wells completed in 1987. The remainder were dry wells, which have averaged about 31% of all wells drilled for the last decade.

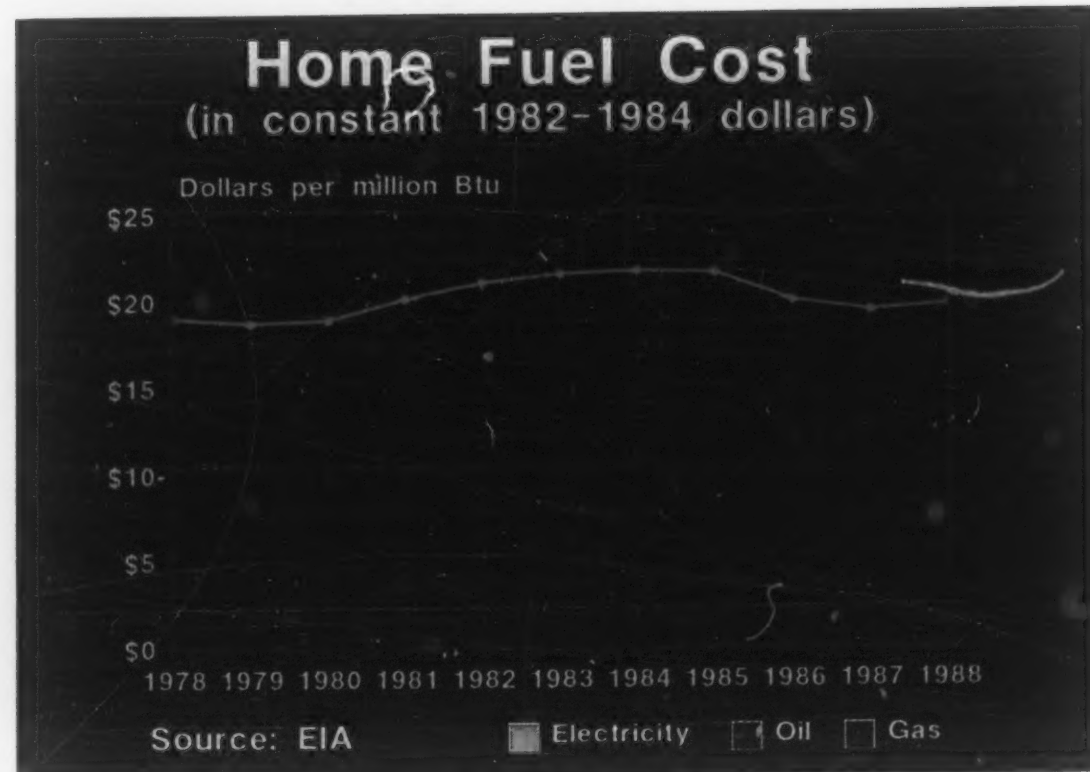
Total footage drilled in 1988 amounted to 143.48 million ft, down 7.4% from the prior-year total of 154.94 million ft. In the peak year, 1981, a total of 408.84 million ft were drilled.

In 1988, the average number of rotary drilling rigs in operation was 936, the same as for the previous year. Of these, 87% were on land and 13% were offshore. The average number of crews engaged in seismic exploration in 1988 was 182, up 3.4% from the previous year's average of 176. Of the 1988 total, 84% were on land and 16% were in marine vessels.

Imports

United States net imports of energy for the first 11 months of 1988 amounted to 11.541 quads, a 5.4% increase over the 10.949 quads of energy imported during the same period in 1987. This amounts to 15.9% of domestic consumption. Or, put another way, the U.S. produced 84.1% of all the energy it consumed during the first 11 months of last year.

Of the 11.541 quads imported during the first 11 months of 1988,



crude oil accounted for 9.628 quads, or 83.4%; Petroleum products accounted for 2.696 quads, or 23.4%; natural gas accounted for 1.116 quads, or 9.7%; electricity accounted for 0.276 quads, or 2.4%; coal and coke imports accounted for 0.36 quads, or 0.3%; and, on the positive side, coal exports accounted for 2.211 quads, or 19.2%.

Significantly, in the third quarter of 1988, the U.S. was importing 6,353,000 barrels of petroleum/day, or 37.6% of all U.S. petroleum products supplied to U.S. markets, down from 40.1% at the same time a year earlier. Of the imports, 55.8% came from OPEC (Organization of Petroleum Exporting Countries) and 31% came from Arab OPEC nations.

In dollar terms, the \$8.186 billion in U.S. energy exports in 1988, up 6.1% from \$7.713 billion in 1987, fell far short of the \$41.088 billion in energy imports, even though imports dropped 7% from the \$44.22-billion total for 1987. However, the negative trade balance was reduced by 9.9% from \$36.507 billion in 1987 to \$32.902 billion last year.

The nation has had a negative energy trade balance every year since at least 1974. It reached a peak of \$74.9 billion in 1980 and dropped gradually to a post-1976 low of \$29.195 billion in 1986.

Coal

The U.S. coal industry produced a record 952 million tons of coal in 1988, up 4.6% from the 910 million tons produced in the previous year, according to estimates of the National Coal Association (NCA).

Because 6 million tons of coal were taken from stockpiles last year, 1988 coal consumption totaled 958 million tons, an increase

of 5.5% over the 908 million tons consumed in the previous year.

NCA's Economics Committee forecast that coal production in 1989 will total 966 million tons, an increase of 1.5% over last year's performance. Consumption is expected to total 967 million tons, up 1%.

Coal consumption in 1988 by electric utilities, the industry's biggest customer, totaled 747 million tons, an increase of 4.6% over the 714-million-ton total for the previous year. Utility coal shipments in 1989 are expected to increase by 1% to 754 million tons.

Coking coal, despite increased competition from electric furnaces and continuous casting, showed an increase of 11.4% in 1988 to 39 million tons. The 1987 total was 35 million tons. A flat year is forecast for 1989.

The industrial and retail sector, which accounted for 83 million tons in 1988, showed a 2.5% increase over the 81 million tons consumed the previous year. A one million ton increase is forecast for 1989.

Coal exports in 1988, at 89 million tons, were up 14.1% from the previous year's total of 78 million tons. Exports to Canada increased from 15 million to 18 million tons, and overseas shipments totaled 71 million tons.

Even though exports to Canada are expected to drop by 2 million tons this year, an increase in overseas shipments to 74 million tons is expected to produce a slight export increase in 1989 to 90 million tons.

Of total coal production, 591 million tons (62%) were produced in the East and 361 million tons (38%) were mined in the West last year.

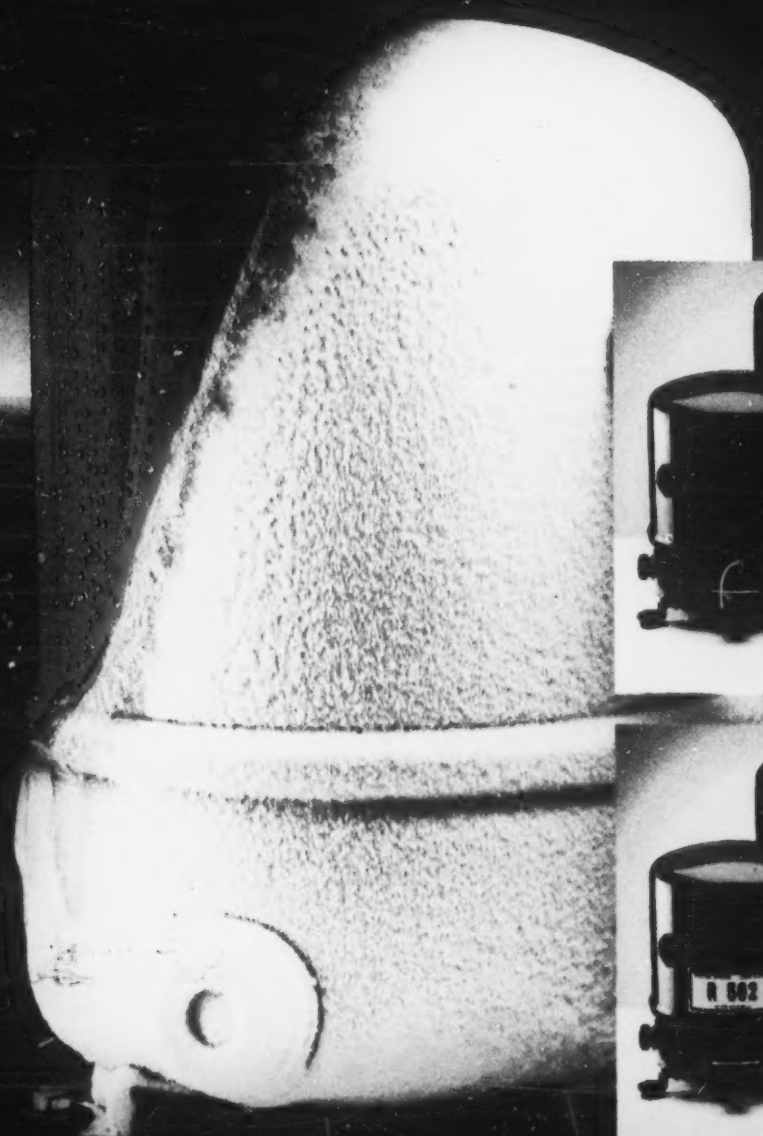
Moderation in the number of high-wage settlements in the Northeast, in the number of multiyear agreements, and in average wage increases highlighted the 1988 collective bargaining season, according to the Construction Labor Research Council (CLRC).

The average first-year increase in 1988, at 54 cents/hour or 2.2%, was unchanged from the previous year's experience. It was the sixth year in a row that the average

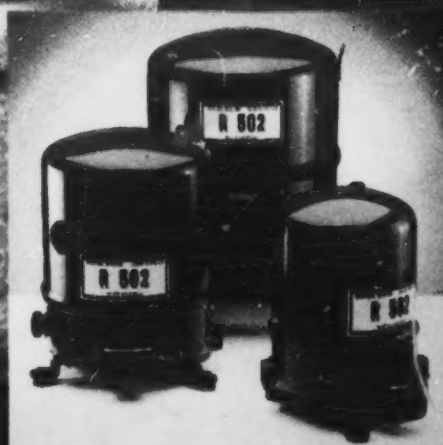
first-year increase has been under 2.5%. And, unlike the recent past, changes in contract language had little impact on the cost of new agreements.

The average second-year increase in multiyear contracts was 58 cents/hour, or 2.6%, the lowest since CLRC began reporting on negotiation results in the mid-1970's. Average second-year increases declined each year since 1981 until 1987, when Northeast

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LABOR

agreements pushed the average to 90 cents/hour, or 3.7%.

The CLRC report included the results of 631 agreements negotiated over the past year and covered 557,640 construction workers. It's significant that strikes or lockouts were not mentioned.

The impact of both multiyear contracts and regionality has moderated. Although multiyear contracts still accounted for 46% of the total, they no longer represent the majority. This is due primarily to the shift in bargaining activity away from the Northeast, which last year included 18% of covered workers compared to 32% in 1987.

Among the multiyear agreements, three-year contracts were more prevalent than two-year pacts. Multiyear agreements also were more common among contracts covering larger numbers of workers. Regions experiencing the most freezes and rollbacks, such as the South Central and Mountain states, had the most one-year contracts. Only 72.3% of all contracts contained increases in wages or benefits.

The greatest portion of the increases was allocated to wages, or 27 cents/hour. Health and welfare contributions, with an average increase of 13 cents/hour, followed. Pension fund increases averaged 4 cents/hour and contributions to other funds averaged 4 cents/hour.

On a regional basis, the two Northeast regions recorded first-year increases almost double the national average. Oil-producing states, such as Texas, and the Mountain and Northern Plains states, registered declines averaging about 1%. California unions showed an average increase of only about 1.2% last year.

Meanwhile, employment remained strong for the 5.4 million workers engaged in construction, CLRC reported. Industry unemployment fell below 10% for the first time since 1979.

UA and SMWIA

Of the 64 contracts negotiated by the United Association (pipefitters and plumbers) covering 43,896 workers, 22 contracts (34.4%) were for more than one year.

The average increase in the first year was 39 cents/hour, or 1.7%, up from 32 cents/hour or 1.4% in 1987. The average increase in the second year of multiyear agreements was 67 cents/hour, or 2.7%, up from 53 cents/hour or 2.2% in 1987. None of the 1988 agree-

ments provided for cost-of-living adjustments.

Of the 59 agreements negotiated by the Sheet Metal Workers' International Association (SMWIA) in 1988 covering 22,388 workers, 20 contracts (33.9%) were for more than one year.

The average increase in the first year was 51 cents/hour or 1.9%, down from 62 cents/hour or 2.3% in 1987. The average increase in the second year of multiyear agreements was 93 cents/hour, or 3.6%. No multiyear agreements were negotiated in 1987 and, in 1988, only one contract contained a cost-of-living adjustment.

Some other views

A survey conducted by the Service and Maintenance Bureau of the Mechanical Contractors Association of America (MCAA) revealed that the average base wage rate for union service technicians in 1988, including wages and fringes, was \$23.84/hour. That's a 17.1% increase over the 1985 rate of \$20.36/hour.

The average cost the 600 SMB union shops charged for one hour of service in 1988 was \$55, up 31.4% from the \$41.84 charged three years earlier. The increase also includes a 24.8% increase in the expense for salaried service department personnel.

Nonunion rates

So far we have dealt with union wages where information is more readily available. Data for open shops, which account for about 80% of the nation's hvac contractors, is much more difficult to come by.

A survey of *News* readers in 1988 revealed that the average payroll labor cost, including fringes, ranged from \$14 to \$18 an hour. The average charge-out rate ranged from \$35 to \$39 an hour for this predominantly open shop group.

Broken down by union and open shop segments, we found that payroll labor costs for union contractors ranged from \$19 to \$26 an hour and, for open shops, from \$14 to \$18 an hour. The median charge-out rate for union contractors ranged from \$40 to \$44 an hour and, for open shops, from \$30 to \$34 an hour.

Average sales per service technician, at \$109,244 in 1988, also was higher for union shops. The open shop average was \$79,494. The average for all contractors was \$84,028.

Another *News* survey conducted in late 1988 indicated that the me-

dian annual salaries of service and installation mechanics ranged from \$20,000 to \$25,000. Among union shops, a median of \$30,000 to \$34,000 held for both categories. But, for open shops, the median for service mechanics ranged from \$20,000 to \$24,000 and, for installation mechanics, from \$15,000 to \$19,000.

Both groups were paid more in the Northeast than in other parts of the country, in larger rather than smaller shops, and in urban rather than suburban or rural locations. The same held true for presidents and/or owners, with a median salary in 1988 that ranged from \$40,000 to \$45,000.

Manpower issues

Aside from immediate wages

and employment levels, the construction industry faces another concern brought about by the baby bust. Shortages of skilled construction workers, already evident in the Northeast, are sure to grow as construction competes for talent in a slow-growing work force that is increasingly made up of women, minorities, and immigrants.

This concern is compounded by a school system which, through permissive course selection, has created a situation where four-fifths of students are lost to science and engineering by the time they reach the 10th grade. It's a fact of life that puts increasing pressure on employer-sponsored training to improve the effectiveness of present employees.

The U.S. Labor Department con-

tends that, through the end of this century, the U.S. population and labor force will grow more slowly than at any other time since the 1930's. Even though mechanical engineering still is among the top engineering choices, today's students tend to see engineering as a career for nerds.

And, in 1986, women made up only 4% of the engineering work force, according to the National Science Foundation. Only 5.4% of engineers are of Hispanic origin and only 2% are black.

The Labor Department predicts that, between 1986 and 2000, the number of construction craft jobs will increase by 823,000. But the replacement of those who die, retire, or leave the industry will

(Next Page, Please)



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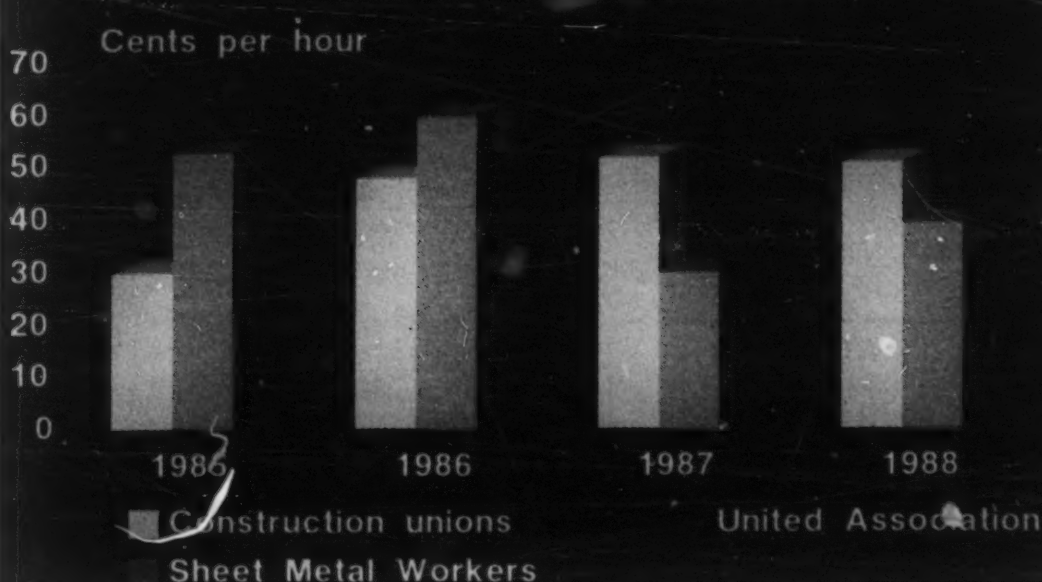
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NEWS1

Union Wage Increases

Industry, UA, and SMWIA



Labor

(Continued from Preceding Page)

boost the annual training requirement to 200,000.

Construction unions and their members' contractor employers are now spending \$500 million a year on training and retraining. They have 160,000 apprentices in programs that typically take four years to complete. Of the total, the Labor Department estimates 8% are minorities and 2% are women.

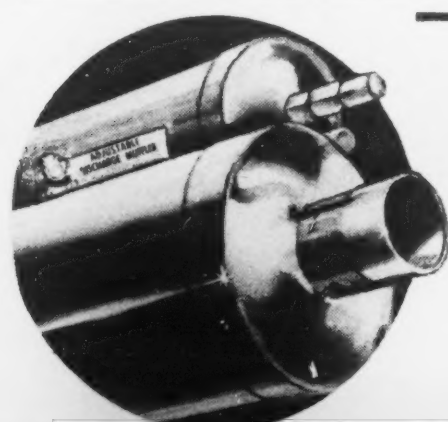
The Associated Builders and Contractors (ABC) are graduating annually from open shop training programs. That total, however, includes journeymen, apprentices, and workers who have completed brief task training.

Closer to home, the Bureau of Labor Statistics estimates that the need for pipefitters and plumbers will grow 17.2% — from 402,000 in 1986 to 471,000 by 2000. The separation rate, however, will be 15.4%.

In the case of training, the Bureau of Apprenticeship and Training reports there are now 12,172 pipefitter and plumber apprentices in the pipeline, 98.7% of them male and 13.7% of them minorities.

Similarly, there are 10,846 sheet metal worker apprentices in the pipeline, 96% of them male and 18.3% of them minorities. Among operating engineers, 18.6% are female and 37.1% are minorities.

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Circle 43

Air cleaner helped smoker kick the weed 30 years ago

by Frank Green

What on earth does an electronic air cleaner have to do with one's quitting smoking? Aren't there enough valid medical reasons to quit?

Yes, today there are, but 30 years ago there weren't. The evils of smoking were almost figments of imagination among those who professed the wisdom of abstinence. And the tobacco companies were in their heyday of advertising and promotion. Smoking was the social mark of distinction in all walks of life — bar none.

We in this industry must admit that, because smoke is an airborne contaminant and because our hvac products deal in air as our comfort and life support medium, there is a relationship.

Please permit a personal story about how an electronic air cleaner influenced me to take the pledge and stop forever. Perhaps this story may have an impact on those who want to quit but haven't found the way yet. Nothing new or revolutionary or spectacular here, just something that happened, almost by chance.

Our family distributing firm took a certain amount of pride in the pioneering work we did in the early 1950's to promote the "total comfort" concept — comprised of heating, cooling, power humidification, and electronic air cleaning. These products at that time were generally not available from just one supplier source. Instead, we took advantage of buying from those manufacturers who specialized in these products. Thus, it became easy for us to offer a "packaged" group of equipment to fit each specific job.

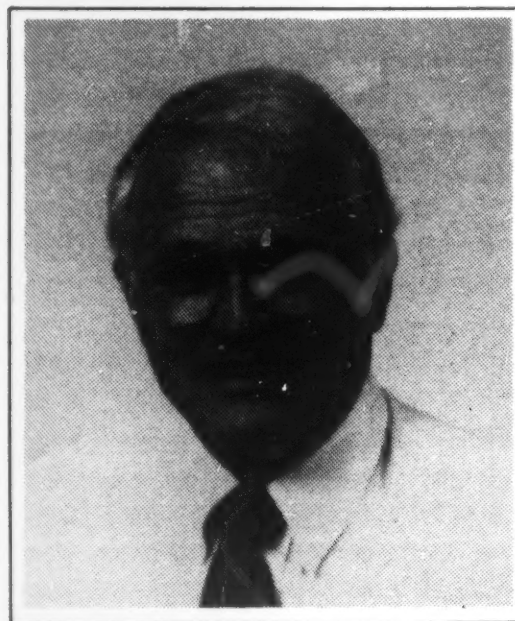
However, there was a real problem at both dealer and consumer levels. Not too many were familiar with this total comfort concept, what it could do, and the products needed to do it. Electronic air cleaning was the most difficult to sell because we were dealing with airborne particles not easily visi-

ble to the naked eye.

Like insurance, the intangibility of clean air was a problem because it presented no effect upon the human senses of sight, sound, smell, or touch.

Demonstrator unit

Fortunately, if you wish to call it that, tobacco smoke is visible in the air and smoke particles are removed by the electronic air cleaner process. This is in contrast to the "white dust" particles, produced by atomizing hard water, which are not removed. Our electronic air cleaner supplier was acutely aware that real life demonstration was the only way



Frank Green, now retired, has held many marketing positions in the hvac industry.

It was an exciting, real-life demonstration — and visible! Although an electronic air cleaner will not collect the inert gasses produced by the burning tobacco, it does get the nicotine and tar. And that's what we saw happen.

to convince a prospective buyer.

They made available a slick sales tool — the "Little Joe" demonstrator. Little Joe was nothing other than a miniature, self-contained unit in a cabinet about 10 in. tall, a foot long, and not quite a foot wide. It had a convenient carrying handle and an electric cord to reach the nearest outlet. A glass panel on top and a light bulb inside allowed a view of the inside works, namely the collector cell plates.

To demonstrate, all we had to do was light a cigarette, place it in an opening in the end of a small aluminum cylinder which had a squeeze bulb attached to the other end by a short length of rubber tubing and then "smoke" the cigarette by repeatedly squeezing the bulb. The heavy cloud of smoke was then directed into the inlet of

Little Joe and was drawn through by a small fan on the outlet side.

When the demonstrator was not activated the smoke went right on through and exited with the same intensity as it did going in. But when a button on top of Little Joe was depressed to activate the operation, the smoke particles were then charged by the ionizing section and collected on the cell plates. One could actually see the smoke being drawn to the plate and held there, and nothing came out the discharge opening.

It was an exciting, real life demonstration — and visible! Although an electronic air cleaner will not collect the inert gasses produced by the burning tobacco, it does get the nicotine and tar. And that's what we saw happen.

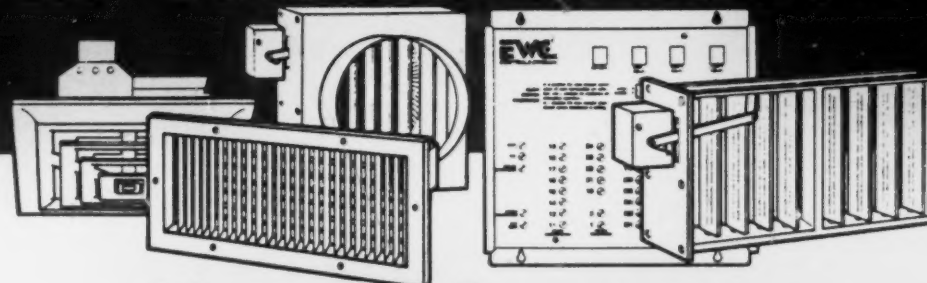
Cleaning the cell

One afternoon, midwestern prudence aided by innate curiosity, gave rise to the fact that Little Joe had been thoroughly abused by repeated use and that it was high time to clean the cell plates. Easily dismantled, the cell was taken to the repair shop with the notion that a little soap and hot water would quickly do the trick.

Wrong! It did not. Even high-power solvents from the repair shop didn't work. By then, it was obvious that improper cleaners were being used, or that no cleaners would work and that Little Joe's highly concentrated smoke demonstrations had, indeed, abused it. Well, Little Joe went back together, rinsed but not cleaned. Clean or dirty, there was no way we would do without our prized demonstrator.

There was a lesson learned from this episode. If nicotine and tar from cigarette smoke can do all that to a few simple aluminum cell plates, then what is it doing to my lungs? After all, the cigarette smoke being inhaled was just as concentrated as that used on Little Joe. A little voice told me that any fool in his right mind would say it is time to quit. And it was done. A target date was set. Both conscious and subconscious minds were programmed to the fact that

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